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**PRELIMINARY DRAFT
GENERAL PLAN REVISION PROGRAM**

HEALTH AND SAFETY SCENIC ROADWAYS

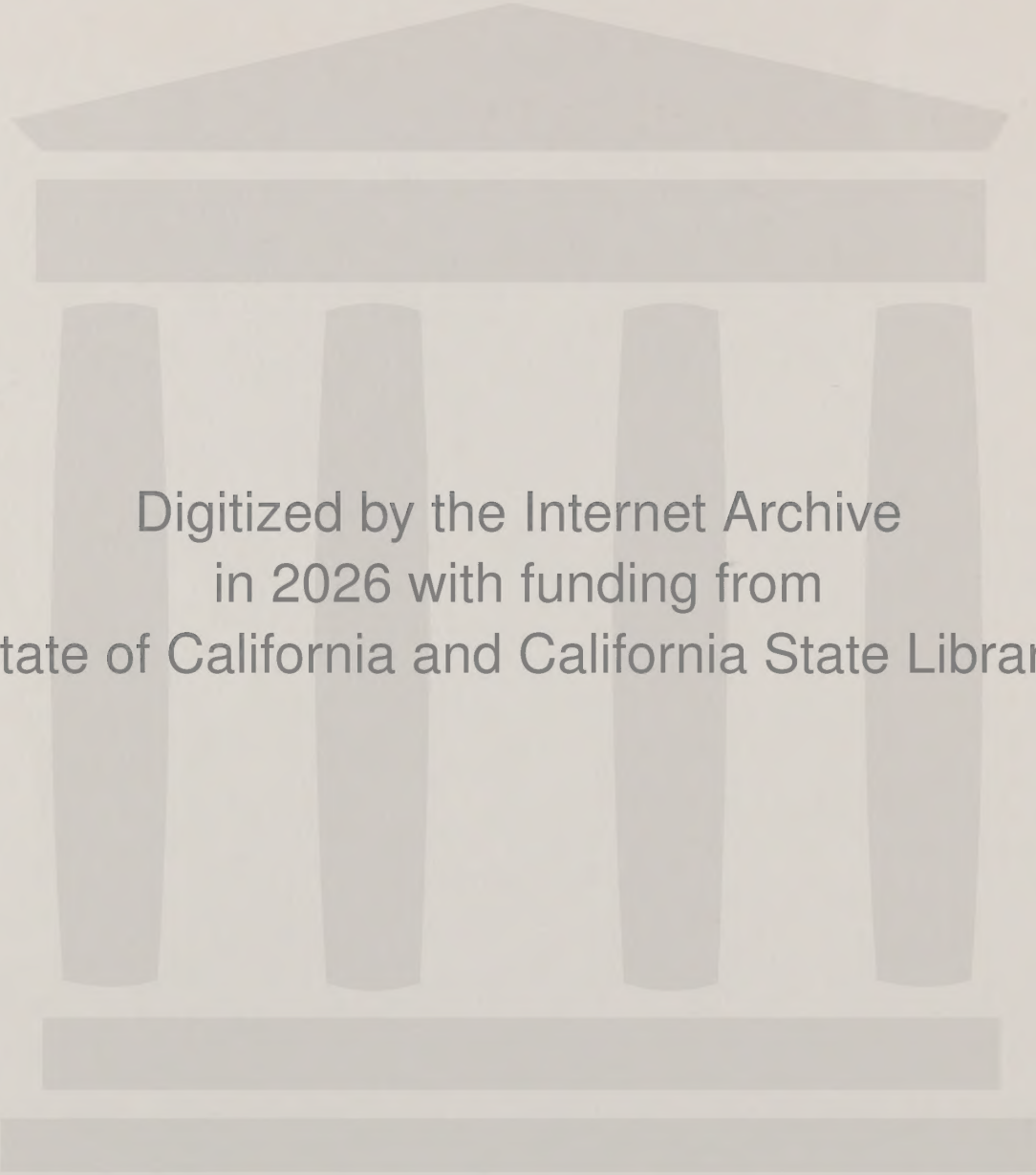
**COUNTY OF SOLANO CITY OF FAIRFIELD
CITY OF VACAVILLE CITY OF SUISUN CITY**

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PRELIMINARY DRAFT
GENERAL PLAN REVISION PROGRAM

HEALTH AND SAFETY

Prepared for the

COUNTY OF SOLANO
CITY OF FAIRFIELD
CITY OF VACAVILLE
CITY OF SUISUN

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December, 1975

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SAN FRANCISCO BAY CONSERVATION
& DEVELOPMENT COMMISSION

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INTRODUCTION

PURPOSE

Significant portions of land within the Solano County, Fairfield, Vacaville, and Suisun City planning areas are subject to a variety of natural and man-induced hazards related to soil instability, seismic activity, flooding, fire, and noise, which threaten community health and safety. The purpose of this health and safety element is both to identify the areas where such hazards to life and property occur and to provide development and protection policies which specifically respond to those hazards. The element will guide the county and participating cities as to what types of land uses shall be permitted or promoted in various areas, how and where to build public facilities, and which type of public services should be provided.

The element is specifically designed to provide the county or cities with a basis for controlling the actions of private individuals or firms and other public agencies who use or propose to use planning area lands. It is structured to be particularly useful in providing both public and private entities involved with the environmental impact assessment (EIR) process with clear direction with regard to the priority of issues which must be addressed for any particular site in the planning area.

Finally, this health and safety element enables the county and cities to fulfill the following legal obligations as set forth in State Planning Law: (1) Government Code Section 65302 (f) which requires the preparation of a seismic safety element identifying and appraising seismic hazards, (2) Section 65302 (g) which requires the preparation of a noise element identifying present and projected noise levels and compatible land use policies, and (3) Section 65302.1 which requires the preparation of a safety element for the protection of the community from fires and geologic hazards. In addition, this element provides the county and cities with an analysis and policy response to flood hazards in the planning area as authorized by Government Code Section 65302 (d).

FORMAT

The element is organized in order of its likely use. Specific policies for land use which are the primary ingredients of the element, comprise the first section. They are followed by a second section which outlines methods for implementing the specific land use policies. And the final section consists of a detailed identification and evaluation of existing conditions in and around the planning area which constitute hazards to life and property and are the basis for the various specific policy responses.

SPECIFIC POLICIES

In formulating these policies, judgements were made in regard to the levels of unacceptable risk above which specific action by government is deemed necessary to protect life and property. The realization of a completely hazard-free environment through adoption of new general plan provisions is highly infeasible, particularly in areas which are already partially urbanized. Natural and man-made hazards of some kind are always present. On the other hand, measures can be taken to mitigate the consequences of identified hazards.

Establishing appropriate degrees of development control involves the recognition of the presence of a hazard, evaluation of its likely severity and frequency, and the characteristics and values of the area involved. Provisions formulated in this element implicitly take into account the cost versus the benefits of different hazard prevention measures and acknowledge the intangibles involved.

SEISMIC AND GEOLOGIC HAZARDS

SLOPE INSTABILITY

Severe slope instability hazards are known to exist in certain Fairfield, Vacaville, and unincorporated Solano County areas. The specific policies enumerated below respond to the levels of hazard associated with two zones and degrees of slope instability, Type A and Type B areas, as designated on Figure 1 and defined as follows:

Type A Lands. Type A lands are almost exclusively those classified in Slope Instability Category 5, areas composed mainly of existing landslide deposits, and Category 4, areas highly susceptible to future landsliding. Both categories are described in detail on page . Although there may be small, isolated pockets of more stable land within areas designated as Type A, road and utility access to these more stable areas would have to cross unstable lands.

Type B Lands. Type B lands consist of areas where there may be extensive portions classified in Slope Instability Categories 5 and 4, but where there are also large areas of more stable land which may be safely accessible for development purposes.

An exceptionally wet winter, an earthquake, or even seemingly minor changes in ground condition caused by development, could trigger major landsliding in these designated areas. If unrestricted development were to occur on Type A and B lands, slope instability conditions, related hazards to life and property, and the likelihood of additional public expenditure to maintain utilities and roads, would be exacerbated.

Specific Policies

Any development on Type A or Type B lands shall comply with the following provisions:

1. Type A lands shall be restricted to open space uses only, such as extensive agriculture and outdoor recreation, and to structures auxiliary to those uses. All secondary roads and utilities which support allowed land uses shall be privately maintained.
2. Construction of new public roads and utilities shall not be permitted on Type A lands unless no alternative routes are possible. In the latter event, special construction precautions shall be taken to minimize hazards and maintenance costs.
3. The county and cities shall adopt a land capacity ordinance for Type B lands which will set allowable densities based on the actual amount of buildable land. Lands in Slope Instability Categories 5 and 4 would be considered in the ordinance as unbuildable. The land capacity ordinance shall require submittal by the applicant of the results of a detailed site analysis including soils, geologic and seismic data, by a geologist registered in this state with certification in engineering geology.
4. The county and cities shall retain a geologist registered in this state with certification in engineering geology, to review all development applications involving Type B lands. Costs of such consulting services as they relate to a specific development proposal shall be incurred by the applicant.
5. Any minor subdivision and, in lieu of a landslide contingency fund, any major subdivision on Type B land shall be required to comply with a more stringent set of engineering standards for structures, roads, and utilities, such as:
 - a. Requirements for structural foundations specifically designed to accommodate stresses and strains associated with minor ground movement (soil creep, etc.). For example, use of pier grid or mat foundations might be considered as preferential to minimum UBC standards.
 - b. Further restrictions on grading, limiting excavation to those operations which enhance ground stability without drastic site modification.
 - c. Special surface or subsurface drainage requirements intended to improve the factor of safety against ground movement or failure.
 - d. Requirements for adequately detailed geologic and soil engineering investigations in the field and laboratory and special geotechnical or structural design analysis where evidence indicates that conventional development practices may not assume trouble-free performance.
6. For those Type B lands where development seems imminent, the county and cities

should prepare more precise or specific area plans which would include analyses of soil, geologic and seismic conditions and recommend appropriate planning and engineering measures. Such studies would also provide an integrated and efficient means of environmental impact assessment. Plan preparation could be financed by groups of interested developers as part of the EIR process or through special assessment district procedures.

SURFACE FAULTING

Geologic evidence indicates that the planning area is traversed by a number of faults (i.e., fracture zones in the earth's crust along which there has been displacement). Any surface displacement in excess of a few inches along one of these faults occurring beneath a building, transportation facility, main utility line, aqueduct, etc., could cause serious structural damage to overlying facilities.

Known fault traces in the planning area are indicated on Figure 1. Some are considered active, i.e., capable of displacement in the near future. The activity of others remains unknown.

Hazards associated with current land use policy and planning area fault traces are indicated on Figure 11. Hazards associated with major utility alignments and fault traces are shown on Figure 12.

Specific Policies

The following provisions address hazards associated with potentials for surface faulting:

1. No structure for human occupancy, other than one-story wood frame structures, shall be permitted within one hundred (100) feet of an active fault trace as designated on maps compiled by the State Geologist under the Alquist-Priolo Geologic Hazards Zone Act, (or 50 feet for one-story, wood frame dwellings).
2. The county and cities shall require that any proposals for a major subdivision or for a facility which attracts numbers of people, is open to the general public, or provides an essential community service, which fall within one quarter mile of a known, concealed or queried fault, shall be subject to one of the following requirements:
 - a. The proposal shall be accompanied by a detailed site investigation by a geologist registered in this state with certification in engineering geology. The investigation shall locate all surface fault traces within 100 feet of any proposed structure and determine their relative activity, using trenching and geophysical methods as necessary. Proposals shall also include adequate provisions for mitigating the hazard potentials to human life and property due to displacement of any identified fault trace.
 - b. The county or city could choose not to approve any development applications

Note

A large blackline print of the figure associated with the following legend has been submitted separately with this preliminary draft. Subsequent to staff review and approval, the figure will be reduced to 11" by 17" and included here with the final draft of this element.

FIGURE 1 SEISMIC AND GEOLOGIC HAZARDS

SLOPE INSTABILITY

TYPE A CATEGORY - Predominantly lands highly susceptible to landsliding



TYPE B CATEGORY - Extensive landslide-prone areas intermixed with more stable soils

SURFACE FAULTING - ACTIVE FAULT TRACES



KNOWN



ALQUIST/PRIOLO ACT SPECIAL STUDIES ZONE BOUNDARY



INFERRED



CONCEALED

SURFACE FAULTING - FAULT TRACES OF UNKNOWN ACTIVITY



KNOWN



INFERRED



CONCEALED



UNCERTAIN

GROUND SHAKING



LOCATION OF PRE-1933 TWO STORY (+) MASONRY STRUCTURES

GROUND FAILURE - AREAS SUBJECT TO LIQUEFACTION

BAY MUD



PRIME AGRICULTURAL SOILS WITH HIGH WATER TABLES

until it prepares a more precise or specific area plan for the subject area which includes detailed mapping of active or potentially active fault traces and recommends appropriate planning and engineering measures to mitigate related hazards. Such a study would also provide an integrated and efficient means of environmental impact assessment. Plan preparation could be financed by groups of interested developers as part of the EIR process, or through special assessment district procedures.

3. The county and cities shall treat the northern extensions of the Green Valley fault (north of the Green Valley Creek) as potentially active. No structures for human occupancy shall be located within one hundred and fifty (150) feet of these designated fault traces unless a geologic investigation by a geologist registered in this state with certification in engineering geology shows that no active fault trace occurs within one hundred (100) feet of the proposed structure (or 50 feet for one-story wood frame dwellings).
4. The county and cities shall retain a geologist registered in this state with certification in engineering geology, to evaluate the geologic reports required herein. Costs of such consulting services as they relate to a particular development proposal shall be incurred by the applicant.
5. All existing and proposed highway construction which falls within an Alquist-Priolo Act Special Studies Zone shall be reviewed to ensure that grade-separated interchange structures are not located on or near an active fault trace.
6. Crossing of a Special Studies Zone by new public and private transmission facilities, including power and water distribution lines, sewer lines, gas and oil transmission lines, shall be restricted by the cities and county. If there are no reasonable alternative alignments, facility design must be satisfactorily shown to include sufficient provision for valves, switches, and other equipment appropriate to insure minimum adverse impact to surrounding development from fire, disruption or continuity of service, spillage, etc., as a result of fault displacement.
7. Any existing facility which is located within the boundary of a Special Studies Zone and attracts numbers of people, is open to the general public, or provides essential community services, shall be investigated by a structural engineer licensed in this state for potential hazards to life and property due to fault displacement. The cost of such investigations shall be incurred by the building operator. If hazards are identified, appropriate hazard mitigation actions, subject to city or county approval, shall be taken.
8. The cities and county shall determine what natural gas wells feed pipelines which cross any Special Studies Zone (Alquist-Priolo Geologic Hazards Zone Act) and whether or not those wells or their associated pipelines are equipped with pressure-operated safety valves, chokes, or other devices capable of automatically shutting off gas flow in the event of pipeline rupture due to fault displacement. Owners of those particular wells and pipelines shall be required to install adequate emergency shut-off devices on wells or pipelines which are not already so equipped.

9. The city or county shall require owners of all existing oil, gas, water and sewer pipelines which cross active faults to file with the city or county an operations plan describing the probable effects of pipeline failure at the fault and the various emergency facilities and procedures which exist to assure that failure does not threaten public safety.

10. Secondary or contingency earthquake disaster evacuation and aid routes shall be planned by the cities and county in coordination with the Emergency Services Office, as alternatives to those currently-designated principal evacuation routes which cross active fault traces (see Figures 1 and 12).

11. The county and cities should investigate the possibility of coordinated efforts at gathering geologic data on those faults of unknown activity near urbanizing areas, with HUD-USGS or the State Division of Mines and Geology.

12. The county and cities shall initiate a joint data collection program to accumulate geologic information relevant to development review and planning purposes, for all faults which are in proximity to developing areas (Green Valley, Vaca Valley, Lagoon Valley, Kirby Hills fault, etc.). A duplicate file shall be established in each of the participating planning departments for storage of all reports, maps, and other pertinent data. To ensure its use and completeness, reference to the file shall be required as part of normal development review procedures. The file will be particularly useful for reviews of those preliminary development proposals which may require accompanying geologic reports, since certain investigation requirements could be waived where adequate, detailed information on an area is already on file.

SEISMIC SHAKING

Seismic shaking is by far the greatest single cause of earthquake damage. Solano County has had a history of earthquake shaking which spans more than 150 years and has often involved casualties and severe property damage. It is clear that the county is in an area of relatively high seismicity. No part of Solano County will be free from the effects of future seismic shaking.

Specific Policies

All Solano County, Fairfield, Vacaville, and Suisun City land use shall comply with the seismic shaking-related policies enumerated below. Reference should also be made to those specific policies which respond to particular effects of seismic shaking, i.e., slope instability, ground failure, and dam and levee failure inundation.

1. All new buildings shall conform to the latest seismic structural standards of the Uniform Building Code as a minimum standard. In addition, since UBC standards do not guarantee against significant seismic damage and do not consider the varying underlying geologic conditions of a particular site, plans for buildings subject to public occupancy other than single-story woodframe structures and one- or two-family woodframe dwellings,

(a) be accompanied by an investigative report prepared by a geologist registered in this state with certification in engineering geology, which identifies underlying geology and recommends structural measures necessary to adequately resist the level of seismic response associated with the underlying geology, and (b) shall be signed by a civil or structural engineer registered in this state.

2. Since human safety is currently most threatened by structural hazards in existing buildings, the county and cities shall institute a comprehensive seismic hazard abatement program which may include the following inspection and enforcement measures:

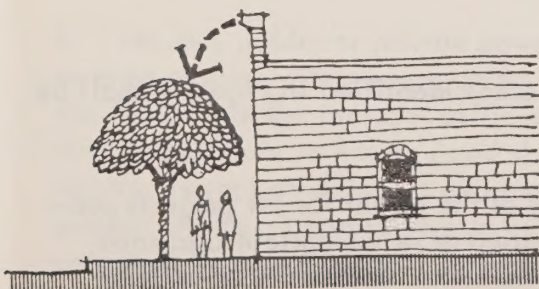
a. The structural condition of all pre-1933 masonry buildings which are used for assembly types of purposes, or provide essential community services, shall be investigated by a structural engineer licensed in this state for potential threats to public safety. Such investigations shall be the responsibility of the building operator. If hazards are identified, structural upgrading to quake-safe standards shall be undertaken or such occupancy shall be discontinued.

b. Upon termination of present use or application for zoning change, approval of any new use of a pre-1933 masonry building which will involve human occupancy shall be subject to investigation for structural adequacy under seismic loading. If hazards are identified, approval of the new use shall be contingent upon structural upgrading to quake-safe standards.

c. Variances from these quake-safe structural requirements may be allowed for one-story structures except when used for assembly types of purposes.

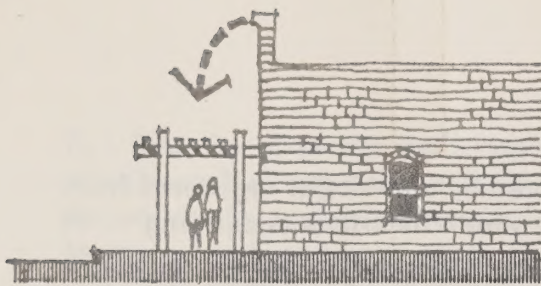
d. Parapets, signs, and other appendages on all buildings in active commercial and industrial areas shall be inspected by a structural engineer licensed in this state for stability under seismic loading. Such inspections shall be the responsibility of the building operator. Adequate reinforcement or removal shall be required as necessary to mitigate identified hazards.

e. Where compliance with such hazard abatement requirements will necessitate demolition or drastic modification of the character of a building of significant visual or historic value, the county and cities shall take cooperative action to encourage the retainment of those structures or features. For example, one of the following measures might be considered in lieu of standard hazard abatement requirements:

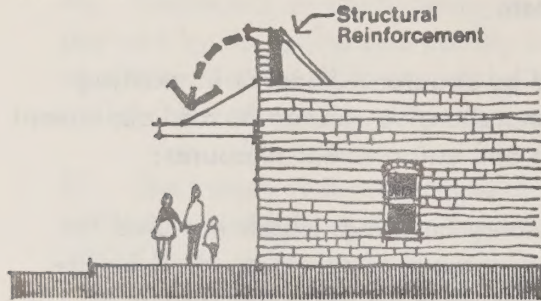


STREET TREES

-Planting of street tree varieties of sufficient canopy and strength (thickness) to break the fall of a collapsing parapet.



TRELLIS



CANOPY

-Construction of a trellis or overhang which would be architecturally compatible with the subject structure and would be of sufficient strength to break the fall of a collapsing parapet.

-Provision of tax incentives or low interest loans to encourage structural repair or reinforcement in lieu of removal or demolition.

3. Creekside development shall be subject to minimum setback requirements between creek bank and structure based upon the susceptibility of the bank to seismic shaking-induced lurching. In the absence of specific geologic and soils data, minimum horizontal setback from the creek bank shall be taken to be two times the height of the creek bank.

GROUND FAILURE

Ground failure resulting from earthquake-induced soil liquefaction is an important risk threatening existing and future urbanization in Solano County. Saturated granular materials in liquefaction-prone soils can be transformed by seismic shaking into a fluidlike state, causing ground failure and consequent structural damage to buildings, roads, pipelines, transmission towers, railroad tracks, etc.

Soil layers with high liquefaction potential are particularly common in those county areas of existing and former marshland underlain by saturated bay mud and where prime agricultural soils are combined with high water tables. Liquefaction potential in the central and eastern portions of the county has increased in recent years due to a ground water table rise brought about by the cessation of ground water withdrawal from wells tapping the area's extensive subsurface aquifer in favor of a new and less costly surface water source, the Putah South Canal.

Specific Policies

All lands which fall within the liquefaction-prone areas identified in Figure 1 shall be subject to the following provisions:

1. Appropriate site investigation shall be required at the outset for all projects proposed for areas identified as underlain by a combination of prime agricultural soils and high water tables and for all projects, except one- and two-family woodframe dwellings, proposed for areas underlain by bay mud. Investigations shall examine such factors as depth of water table, thickness and compressibility of bay mud, depth to bedrock, presence of layers and lenses of sand, technical description of any engineered fill, etc., and the structural design implications of these factors.

2. For lands confirmed by site investigation as prone to ground failure, the following special procedures shall be established for the remaining development review process:

a. All proposed site modifications, structures, roads, and utilities shall be carried out in accordance with the recommendations of a civil engineer licensed in this state.

b. The county or city shall retain an independent consultant to evaluate the site investigations and professional recommendations required herein. Costs of such consulting services shall be incurred by the applicant. (This extra precautionary step is considered essential since there are currently differing professional interpretations regarding the safeguards required in such areas. Such a procedure would give the Planning Commission and the Board of Supervisors or City Council the benefit of several professional judgements and would focus attention on any unresolved public safety issues. The Bay Area Conservation and Development Commission presently uses a similar procedure on bayfront lands. In this instance, they use a three-member technical committee to review development applications.)

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3. In lieu of requiring independent site investigations, the county or city could choose not to approve any development applications until it prepares a more precise or specific area plan for the subject area which includes a thorough analysis of ground failure potentials and recommends appropriate planning and engineering measures to mitigate related hazards. Such studies would also provide an integrated and efficient means of environmental impact assessment. Plan preparation could be financed by groups of interested developers as part of the EIR process, or through special assessment district procedures.

4. In areas of prime agricultural land and high water tables where a lowering of the water table would protect valuable croplands or provide for safe and acceptable development, the county or cities should:

a. Encourage a return to ground water withdrawal for irrigation purposes through a program which would adjust the cost of well water to the user to a level below the cost of canal water.

b. Institute a program of ground water extraction in selected areas to lower the water table for crop growing and other land use purposes.

5. No new public or private power, water, sewer, or gas lines shall be permitted to cross ground failure areas unless reasonable alternative routes are not available or the facility design includes sufficient provision for valves, switches, and other equipment appropriate to ensure rapid shutoff, minimum disruption of service, and minimum adverse impact on adjacent and surrounding areas in the event of seismic-induced ground failure. Lines shall also be accessible for emergency repairs to minimize the potential for extended service interruption.

FLOOD HAZARDS

A large portion of developed and undeveloped planning area lands (30 to 40 percent) are subject to flooding due to a combination of conditions including periodic heavy winter rainfalls, tidal fluctuations, and potential for canal, levee, and dam failure due to seismic activity. These conditions are described in detail in this document under EXISTING CONDITIONS, pp. 46 to 73.

STORMWATER AND TIDAL INUNDATION

The control of watershed runoff and stream overflow is appropriately approached on a watershed basis with a coordinated set of both upstream and downstream land use policies. Upstream policies pertain to lands adjoining streams in the higher elevations and upper reaches of a watershed tributary system. Upstream areas are characterized by varying topography and steep stream gradients, with most slopes exceeding five percent.

Downstream policies pertain to lands adjoining streams in the lowest elevations of a watershed, usually in flood plain areas. Downstream topography is predominantly flat, slow-draining, and in proximity to the bay. Downstream lands may also be subject, to tidal actions which compound flood problems from stormwater runoff.

By far the major portion of flood-prone lands in the planning area are downstream lands which are subject to inundation due to heavy rainfall, watershed runoff, and resulting stream overflows. The potential for downstream flooding is in large part directly related to upstream conditions. A number of streams in the area have long histories of seasonal downstream flooding, often resulting in significant property damage. Most of these floods, however, have not reached the disastrous levels that can be expected from a relatively rare 100-year storm. The estimated inundation area for such an event is mapped on Figure 2.

Upstream flooding, presently a relatively minor problem which can occur where a steep stream gradient flattens abruptly and/or where a channel's capacity is suddenly restricted, may also become a hazard, particularly to certain future upland land uses.

Specific Policies for Upstream Land Use

The following upstream land use and conservation policies serve to mitigate such storm-water inundation potentials by minimizing encroachment on natural drainage courses and increases in the rate of runoff caused by upstream land development:

1. The county and/or cities should undertake a precise hydrological analysis of study area uplands, identifying the different watersheds which drain into the planning area, establishing flood-related objectives and priorities on a study area basis, and translating those into a coordinated series of flood-preventive measures for each watershed.
2. Wherever possible, upstream watersheds should remain essentially devoted to open space land uses such as recreation and extensive agriculture (grazing).
3. The following upstream land use practices often contribute to increased rates of surface water runoff and should therefore be prevented or regulated:
 - a. Overgrazing by livestock
 - b. Logging, clearing, burning, and other activities which can reduce natural vegetative cover
 - c. Construction of extensive impermeable surfaces (large developments which might include a number of structures, patios, dwellings, roads, etc.) over naturally permeable soil and geologic areas
4. Upstream land use controls shall be formulated to protect riparian corridors (the stream, its banks, and creekside vegetation) from encroachment and degradation by development.
5. No development shall be permitted which would interfere with existing channel capacity or would substantially increase erosion, siltation, or other contributors to the deterioration of any watercourse.
6. Integration of riparian corridors (the stream, its banks, and creekside vegetation) into park or trail systems and other common open space uses should be required as a condition for the development of adjoining lands.
7. Where channel capacity is restricted, the county or city shall make channel and embankment improvements, providing that such measures do not conflict with adopted open space and conservation policies.
8. The county and cities shall provide periodic stream maintenance as necessary to clear channels of blockages by debris and silt buildup.
9. In those watersheds which are the major contributors to downstream flood problems, the county and cities should undertake or advocate the construction of upstream flood-water retention devices such as ponds (dams) and/or diversion channels.

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The most widespread damage from stormwater flooding occurs, of course, in downstream areas where relatively flat topography is conducive to slower drainage and resulting inundation. The likelihood of downstream flooding is intensified by the potential for coincident high tides and strong offshore winds during periods of heavy rainfall. The hazards associated with downstream flooding are particularly severe since urbanization has a tendency to spread throughout the more developable flatlands of the county and cities, often encroaching upon floodplain surface areas.

Specific Policies for Downstream Land Use

The following policies serve to significantly reduce risk to human life and potentials for damage to homes, businesses, crops, roads, etc., associated with downstream flooding.

1. Primary flood plain zones (the stream channel and portions of the adjacent flood plain that carry the design flood flows of the stream) shall be protected and maintained through strict limitations on land use, road construction, and land fill. Land uses should be limited to non-urban, low capital investment types of uses.
2. Both the ground floor elevation of any building for human occupancy and the driving surface of designated evacuation routes within the 100-year flood plain as designated on Figure 2, shall be constructed above the projected profile of a 100-year flood event.
3. The county and cities should adopt road construction standards for areas designated as flood prone which allow for the passage of flood water under the road surface unless a diking effect is desired.
4. The county and cities should require that all new and existing development for human occupancy within the 100-year flood plain as designated in Figure 2 be adequately flood-proofed. Specific flood-proofing measures may include permanent sealing of grade level openings; use of paints, membranes, or mortar to reduce water seepage through walls; installation of watertight doors, bulkheads, shutters, and similar closures; installation of floodwater pumps in structures; proper modification or reinstallation of all electrical equipment, circuits, and appliances so that they are protected from inundation by a 100-year flood.
5. The county and cities should implement those flood control and drainage improvement recommendations included in locally-formulated plans, and should advocate those recommendations made by the U. S. Army Corps of Engineers and the Reclamation Board of the State of California, which do not conflict with locally-adopted open space and conservation policies regarding natural water course preservation.

TSUNAMI AND SEICHES

The portion of the planning area which is subject to inundation by tsunami is minimal, as shown on Figure 2. However, should these lands come under pressures for development, and development proposals are compatible with scenic roadway policies, the following provisions shall apply:

Specific Policies

1. Any structures permitted within areas designated as prone to tsunami inundation shall be adequately anchored to resist flotation or lateral movement.
2. The ground floor elevation of any structure for human occupancy, if permitted within areas designated as prone to tsunami inundation, shall be constructed above the projected flood profile level.

DAM FAILURE

There are some 18 dams in Solano County which are currently retaining water. Of these, the State of California Office of Emergency Services has, as required by law, identified eleven of the 18 dams whose failure may cause injury or loss of life. The O.E.S. has prepared maps indicating the inundation area assuming failure for ten of the eleven dams. An identification of the inundation and failure characteristics of the eleventh facility, the Putah Creek Diversion, has not yet been submitted by the facility's owner, the Bureau of Reclamation.

Maps of dam inundation areas are based on the structural type of each dam and its dam failure characteristics, i.e., the likely rapidity and degree of failure and inundation. These O.E.S. maps are summarized on Figure 2. Eight dams in the county (see Table 8) were exempted by the O.E.S. from the inundation mapping program since no injury or loss of life was anticipated with failure.

Specific Policies

The following provisions respond to the potential flood hazard to human life and property should any of the 18 dams in the planning area fail:

1. All proposals for development involving human occupancy which fall within dam failure inundation areas as designated on Figure 2 shall be accompanied by a report detailing the results of a dam safety investigation.

Note

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FIGURE 2 FLOOD HAZARD



AREAS SUBJECT TO STORMWATER
AND TIDAL INUNDATION-100 YEAR
FLOOD PLAIN



AREAS SUBJECT TO INUNDATION
DUE TO DAM FAILURE OR
OVERSPILL



AREAS SUBJECT TO TSUNAMI
INUNDATION



EXISTING CANALS AND AQUEDUCTS



PROPOSED CANALS AND
AQUEDUCTS

2. All proposals for development involving human occupancy which are judged by the county or cities to be within the inundation area of a water retention facility which has been exempted from the O.E.S. inundation mapping program shall be accompanied by a report detailing the results of a dam safety investigation.
3. Dam safety investigations as required herein shall be the responsibility of the applicant, be undertaken by a state-registered civil engineer, and shall include the following:
 - a. A thorough inspection of the dam for structural stability, assessing in particular the potential for earthquake-induced failure.
 - b. An identification of the likely characteristics of a potential dam failure, i.e., the area which must be evacuated, evacuation times, inundation profiles (flood depth), etc.
 - c. An identification of measures which will abate dam failure potentials and resulting hazards to human life and property.

CANAL AND LEVEE FAILURE

The Putah South Canal is a potential source of earthquake-induced problems including possible flooding due to slumping, landslides, and liquefaction. And the old levee system which was built years ago to reclaim and protect much of the county's marshland is also a potential source of flooding. The levees are subject to damage due to slumping, liquefaction, peat oxidation, subsidence, and erosion.

Specific Policies

The following provisions respond to potentials for flood damage due to canal or levee failure:

1. All proposals for developments involving human occupancy which fall within potential inundation proximity of a levee or canal shall be accompanied by a report detailing the results of an inspection of the levee or canal by a state-registered civil engineer. The inspection shall focus on the following specifics:
 - a. Hazard potential determinants such as reliability of the facility during a 100-year flood event; rate of settlement (levees only), potential for slumping, and routine maintenance requirements under normal conditions; potential for failure due to seismic shaking (landsliding, slumping, liquefaction, etc.); likely inundation area, flood profile by location, and evacuation times in the event of failure; etc.

b. Any necessary levee or canal improvements that should be made to protect life and property in the proposed development against identified failure and flood risks.

2. Development in areas identified in site investigations as subject to potential canal or levee failure shall be prohibited unless necessary levee or canal improvements are made or special flood-related site and building design standards are met, such as minimum elevation requirements for finished floors of any structure for human occupancy, restriction of grade-level openings, waterproofing of walls and floors, etc.

3. In the event that significant canal-related flood risks are identified, the county and/or cities should request that the canal owner make the proper improvements to mitigate such hazards, particularly where they threaten existing urbanization. (If, for example, investigations of the Putah South Canal as required herein consistently result in flood hazard findings, a request should be made to the Bureau of Reclamation to make the proper improvements).

4. As those public roadways which are atop levees are routinely maintained and improved, the levees themselves should also be improved through repair or reconstruction.

FIRE HAZARDS

Significant portions of foothill and mountainous watershed areas of western Solano County are threatened with wildfire risk due to a dangerous combination of factors including dense build-ups of fire-prone vegetation, the wind funneling effect of steep topography, poor access for fire fighting equipment, lack of water service and adequate water pressure at fire-prone elevations, and seasonal atmospheric conditions (warm, dry falls and summers, and afternoon winds). Extreme wildfire risk areas as designated on Figure 3 are those lands where dense vegetation of severe burning potential prevails (chaparral and heavy woodland). High wildfire risk areas on Figure 3 are those lands where vegetation of high burning potential prevails (mixed woodland and grassland).

In addition to these two areas of wildfire risk, the Montezuma Hills, Benecia Hills, Potrero Hills, Cement Hills, and eastern English Hills are designated on Figure 3 as high grassfire risk areas. Grasslands, which have a high ignition potential, occur in these areas in combination with periodic high winds. Fire risk is significant here, although not as severe as the mountainous wildfire risk areas.

Specific Policies

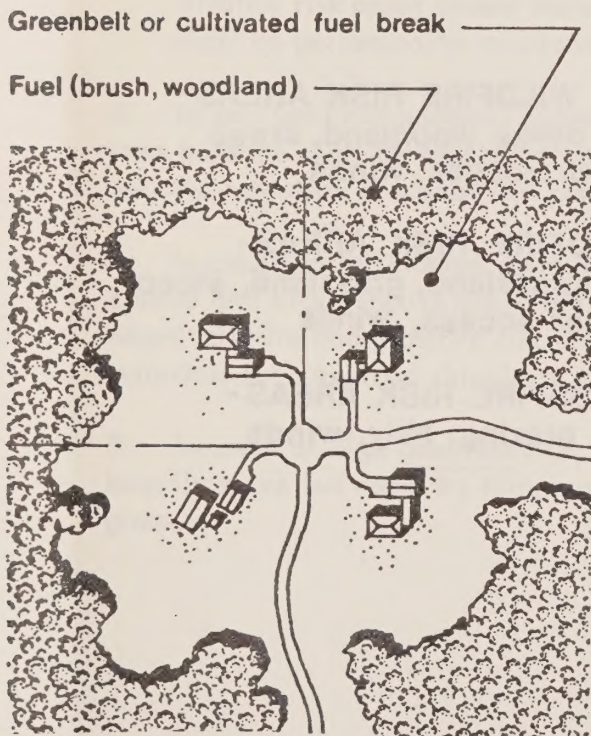
Designated fire hazard areas shall comply with the following provisions:

1. Residential development and road construction for public use shall be prohibited in areas of extreme wildfire risk.

2. Residential development shall be limited to a maximum of one dwelling unit per every five acres of land in areas of high wildfire risk. (Although the prevalent land use designation in these areas restricts development to 20 acre densities, certain subsections of these areas are designated in current plans for inappropriate densities and uses.)

3. The county and cities shall require grouping of residential units to provide for more localized and effective fire protection measures such as consolidation of fuel

buildup abatement, fire break maintenance, fire fighting equipment access, and water service provision; and a more manageable localization or focus of any actual fire-fighting activity. (This would also serve to minimize extensive fuel buildup abatement which could be costly and inconsistent with open space and scenic protection policies of the general plan).



FUEL BREAK

4. In those designated wildfire risk areas where development already exists, the county and cities should undertake or continue any current land management programs to minimize fuel buildup around residences and other occupied structures. Such programs should include the establishment and maintenance of a greenbelt or cultivated fuel break between wildfire risk areas and urbanized areas. Brush, but not grass or woodland canopy should be periodically thinned out or cleared in this buffer zone to a width of at least 200 feet (brush provides an ignition interface between light ground fuels and heavy forest fuels). The dry, lower branches of mature trees in the buffer zone should be removed. Planting of non-resinous, fire-resistant plants and ground covers should be encouraged (these would also serve to control soil erosion).

Note

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FIGURE 3 FIRE HAZARD



EXTREME WILDFIRE RISK AREAS-
Chaparral, dense woodland, steep
slopes, poor access, winds



HIGH WILDFIRE RISK AREAS-
Woodland-grassland, grassland, steep
slopes, poor access, winds



HIGH GRASSFIRE RISK AREAS-
Grassland, grazing, hilly, winds

5. In all designated wildfire risk areas, the county and cities should undertake or continue current programs to manage the interface between light ground fuels and heavy forest fuels so that easily started fires with low burning intensity can be controlled before they have the opportunity to ignite dense chaparral and woodland areas. To accomplish this, the following measures should be taken:

a. Fire buffers should be created along heavily travelled roads by thinning, discing, or controlled burning (the latter is subject to E.P.A. restrictions). Brush, but not woodland canopy, should be cleared back from the road for 50 to 100 feet. The dry lower branches of mature trees should be removed.

b. Current firebreak programs should be continued throughout the interior of these wildfire risk areas where there are no roads. Brush removal for firebreak purposes shall be periodically maintained to a continuous minimum width of 200 feet.

6. In any land management programs for the purposes of fire hazard mitigation, an optimum balance shall be sought between the degree of fire-preventative thinning and clearing, and the retention of visual and natural resource values.

7. In addition to Uniform Building Code construction standards for fire protection, the county and cities should adopt building restrictions for residential development in designated wildfire and grassfire risk areas which prohibit the use of fire-prone exterior materials such as wood shingle or shake roofs.

8. In areas of high grassfire risk, the county and cities shall create fire buffers along heavily travelled roads by thinning, mowing, discing, or controlled burning of roadside grass.

NOISE

The principal source of noise in the planning area is vehicular traffic, followed in intensity and impact by local airport and railroad operations. Current and projected noise contours (the lines of intrusion by a given noise level in dBA) generated by freeways, highways, local arterials, airports and railroads in the planning area are mapped on Figures 4 through 9. These contours represent an average of all noise levels reached during a normal 24-hour day adjusted to an equivalent level which accounts for the greater intrusiveness of evening and nighttime noise. The adjusted noise levels are referred to as Community Noise Equivalent levels (CNEL).

A definition of what constitutes noise, and an explanation of the impact of noise on human beings, the measurement and characteristics of noise, and specific noise conditions in this particular planning area, are provided under EXISTING CONDITIONS, pages 61 through 78.

To avoid annoyance and health problems associated with excessive community noise levels, the policies which follow serve to abate noise both at its impact point and at its source.

Specific Policies

Noise shall be controlled at its existing and projected impact or receptor points through the following policies:

1. Where a detailed noise analysis is required under certain provisions which follow, that analysis shall be the responsibility of the applicant, shall be prepared by a competent acoustical consultant* and shall include a representative set of on-site sound level measurements with appropriate spatial and temporal (day, evening, and night) variations and a delineation of measured present and projected future noise contours ranging from 50 to 75 dBA, within the proposed development site. Where these sound measurements exceed maximum allowable levels, appropriate noise abatement measures shall also be identified in the analysis.

2. Any major land use proposal (major residential subdivisions and other uses for human occupancy) for lands within a designated noise level contour (Figures 4 through 9) shall comply with the land use policies indicated in Table 1. If Table 1 indicates that a detailed noise analysis is required, that analysis shall comply with provision #1 above. Proposed land uses shall be allowed only if the projected effect of proposed noise-abating design features are considered by the county or city to be sufficient to adequately reduce exterior and interior noise to acceptable levels. Interior noise level standards are listed in Table 2.

* A list of accredited noise consultants has been compiled by the California Department of Health, Office of Noise Control, 2151 Berkeley Way, Berkeley CA 94704; phone (415) 843-7900.

TABLE 1. LAND USE COMPATIBILITY CHART FOR EXTERIOR COMMUNITY NOISE

Exterior Noise Level Ranges (CNEL) and Related Land Use Policies (see legend, opposite page)	
Land Use Category	Measured, Estimated, or Projected dBA
	50 55 60 65 70 75 80 85 90
Residential. All dwellings incl. single-family, multi-family, group quarters, mobile homes, etc.	50 55 60 65 70 75 80 85 90
Transient lodging. Hotels, motels.	50 55 60 65 70 75 80 85 90
School classrooms, libraries, churches	50 55 60 65 70 75 80 85 90
Hospitals, convalescent homes, etc.	50 55 60 65 70 75 80 85 90
Auditoriums, concert halls, amphitheaters, music shells	50 55 60 65 70 75 80 85 90
Playgrounds, neighborhood parks	50 55 60 65 70 75 80 85 90
Golf courses, riding stables, water-based recreation	50 55 60 65 70 75 80 85 90
Office buildings. Personal business and professional services	50 55 60 65 70 75 80 85 90
Commercial. Retail, movie theaters, restaurants	50 55 60 65 70 75 80 85 90
Commercial. Wholesale, industrial, manufacturing, utilities, etc.	50 55 60 65 70 75 80 85 90
Noise-sensitive manufacturing and communications	50 55 60 65 70 75 80 85 90

TABLE 1 (continued)

Land Use Policies Legend

-
- Acceptable land use. No special noise insulation requirements.
- New construction or development allowed only after detailed noise analysis of construction requirements is made and needed noise-abatement features are included in design.
- New construction or development should generally be avoided. If development does proceed, a detailed analysis of noise reduction requirements must be made and needed noise-abatement features included in design.
- New construction or development generally not allowed.
-

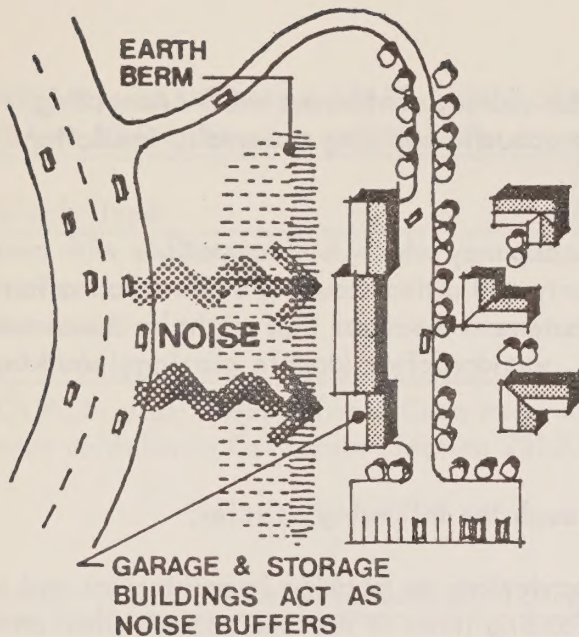
SOURCE: Criteria developed with consideration of Federal Environmental Protection Agency findings on noise levels required for uninterrupted sleep or speech, from statistics on hearing loss in the population at large due to noise, from High Research Board findings (High Research Board, Highway Noise: A Design Guide for Highway Engineers, National Cooperative High Research Program Report 117, 1971), and from knowledge of planning area ambient noise levels.

TABLE 2. LAND USE COMPATIBILITY STANDARDS FOR INTERIOR NOISE IN dBA

Land Use	Maximum Allowable Exterior CNEL	Maximum Allowable Interior CNEL
Residential	50	45
Transient lodging	-	45
School classrooms, libraries, churches	60	45
Hospitals, convalescent homes	55	45

Note: The acceptable interior noise level for other uses (offices, theaters, commercial, industrial) is dependent upon the specific nature of the indoor activity.

SOURCE: Same as Table 1



ACOUSTICAL DESIGN MEASURES

3. The county or cities shall require a noise buffer of 250 feet along major freeways within which all development proposals which would be adversely affected by noise intrusion shall not be allowed until a detailed noise analysis is completed and noise abatement features are included in the development's design. Decreases in noise buffer depth may then be allowed based on county or city judgement regarding the projected effect on interior and exterior noise levels of proposed acoustical design features.
4. Where site conditions permit, noise buffers shall be required along local arterials and railroad alignments (Figures 4 through 9) for all new adjoining development which is subject to unacceptable noise levels as specified in Tables 1 and 2. The required buffer depth shall be based on a detailed noise analysis and on county or city judgement regarding the projected effectiveness of proposed noise-abating design measures.
5. New commercial land uses shall be allowed within designated major freeway, local arterial or railroad noise buffers only after a detailed noise analysis has been prepared and only if the development features an enclosed, interior orientation which, in the county or city's judgement, would adequately abate excessive exterior noise levels identified in the analysis.
6. Noise abatement design measures for new development in areas designated on Figures 4 through 9 as subject to noise intrusion might include the provision of earth berms or solid buffer walls (must be continuously sealed and of adequate height) providing that wall setbacks conform to Scenic Roadway Element policies; special building placement using the shielding effect of other buildings or the orientation of

narrow, unfenestrated sides toward the noise source; continuous walls connecting structures which back on the noise source, acoustic building materials, insulation techniques, etc.

7. For existing development for human occupancy which is incompatible with measured or projected noise contour levels, the county and cities should provide information to occupants and property owners on noise abatement measures that might be taken such as berming, installation of accoustical walls, soundproofing (double glazing, caulking, insulation), etc.

Noise shall be controlled at its source through the following policies:

1. The county and cities should place restrictions on trucking in residential and commercial areas, limiting delivery and loading times to daytime periods when ambient noise levels are highest.

2. The county and cities should establish specific truck routes where noise conflicts with land uses are least likely to occur.

3. The county and cities should maintain smooth street surfaces adjacent to land uses which are sensitive to noise intrusion. For example, grooved concrete pavement should be avoided.

4. The introduction of any fixed point, permanent, non-residential, noise-emitting land use (industrial, commercial, public utility, etc.) shall be prohibited if the projected noise emission level will exceed one or more of the following:

a. 50 dBA CNEL as measured at the boundary of a nearby residential zone.

b. 60 dBA CNEL as measured at the boundary of a nearby commercial zone, business zone (personal services, offices), or noise-sensitive industrial or manufacturing zone (research, communications, etc.).

5. The county and cities should enforce the California State Vehicle Noise Standards for Motor Vehicles listed in Table 3, giving priority to areas where land uses are particularly sensitive to vehicular noise intrusion (residential areas, hospital and school zones, etc.). Local police are responsible for enforcing these noise standards on city thoroughfares. The California Highway Patrol is responsible for such enforcement on local freeways.

6. The county and cities should place restrictions on noise-emitting construction activities based on standards for construction equipment listed in Table 4. (These noise standards are relatively lenient since such activities are temporary and difficult to avoid, i.e., CNEL's as measured at the boundary of a construction site where these standards are enforced will still exceed acceptable standards for normal conditions.)

TABLE 3. CALIFORNIA STATE NOISE STANDARDS FOR MOTOR VEHICLES
(dBA at 50 feet from the center of the travel lane)

Vehicle Type	Less Than 35 mph.	Greater Than 35 mph.
Trucks	88	90
Motorcycles	82	86
Automobiles	76	82

SOURCE: California Vehicle Code noise emission standards for operation of licensed motor vehicles in California (Section 23130).

TABLE 4. MAXIMUM ALLOWABLE NOISE LEVELS FROM CONSTRUCTION EQUIPMENT

Equipment Type	Maximum Noise Level in dBA at 50 feet
Earthmoving	
front loader	75
backhoes	75
dozers	75
tractors	75
scrapers	80
graders	75
truck	75
paver	80
Materials Handling	
concrete mixer	75
concrete pump	75
crane	75
derrick	75
Stationary	
pumps	75
generators	75
compressors	75
Impact	
pile drivers	95
jackhammers	75
rock drills	80
pneumatic tools	80
Other	
saws	75
vibrator	75

Note

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FIGURE 4
NOISE CONTOUR
ESTIMATES - 1975
HIGHWAY, RAILROAD, AND
AVIATION SOURCES

—•— COMMUNITY NOISE EQUIVALENT
LEVEL (CNEL) CONTOURS, dBA

AREAS SUBJECTED TO NOISE
LEVELS OF 65 dBA OR MORE

CNEL noise contours represent the average of all sound levels reached during a 24-hour day. Average figures are adjusted to an equivalent level which accounts for the greater annoyance of nighttime noise.

Note

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FIGURE 5 NOISE CONTOUR ESTIMATES - 1975 LOCAL ARTERIALS- CITY OF FAIRFIELD

—•— COMMUNITY NOISE EQUIVALENT
LEVEL (CNEL) CONTOURS, dBA

AREAS SUBJECTED TO NOISE
LEVELS OF 65 dBA OR MORE

CNEL noise contours represent the average of all sound levels reached during a 24-hour day. Average figures are adjusted to an equivalent level which accounts for the greater annoyance of night-time noise.

Note

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FIGURE 6 NOISE CONTOUR ESTIMATES - 1975 LOCAL ARTERIALS- CITY OF VACAVILLE

—•— COMMUNITY NOISE EQUIVALENT
LEVEL (CNEL) CONTOURS, dBA

AREAS SUBJECTED TO NOISE
LEVELS OF 65 dBA OR MORE

CNEL noise contours represent the average of all sound levels reached during a 24-hour day. Average figures are adjusted to an equivalent level which accounts for the greater annoyance of nighttime noise.

Note

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FIGURE 7 NOISE CONTOUR PROJECTIONS-1995 HIGHWAY, RAILROAD, AND AVIATION SOURCES

 **COMMUNITY NOISE EQUIVALENT
LEVEL (CNEL) CONTOURS, dBA**

**AREAS SUBJECTED TO NOISE
LEVELS OF 65 dBA OR MORE**

CNEL noise contours represent the average of all sound levels reached during a 24-hour day. Average figures are adjusted to an equivalent level which accounts for the greater annoyance of nighttime noise.

Note

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FIGURE 8 NOISE CONTOUR PROJECTIONS-1995 LOCAL ARTERIALS- CITY OF FAIRFIELD

 **COMMUNITY NOISE EQUIVALENT
LEVEL (CNEL) CONTOURS, dBA**

**AREAS SUBJECTED TO NOISE
LEVELS OF 65 dBA OR MORE**

CNEL noise contours represent the average of all sound levels reached during a 24-hour day. Average figures are adjusted to an equivalent level which accounts for the greater annoyance of nighttime noise.

Note

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**FIGURE 9
NOISE CONTOUR
PROJECTIONS-1995
LOCAL ARTERIALS-
CITY OF VACAVILLE**

—•— COMMUNITY NOISE EQUIVALENT
LEVEL (CNEL) CONTOURS, dBA

AREAS SUBJECTED TO NOISE
LEVELS OF 65 dBA OR MORE

CNEL noise contours represent the average of all sound levels reached during a 24-hour day. Average figures are adjusted to an equivalent level which accounts for the greater annoyance of nighttime noise.

MISCELLANEOUS HAZARDS

Hazardous Cargoes

Although potential for mishaps involving hazardous cargoes and land use adjacent to major transportation routes are real in Solano County (see EXISTING CONDITIONS, p. 55), the formulation of land use policies to specifically mitigate such risks becomes another issue concerning the level of acceptable risk. The realization of a completely hazard-free environment along major freeway and railway alignments would entail either a complete prohibition of hazardous cargo transport through the county, the provision in the design of a highway or railway of complete protection against the hazards of dangerous cargo mishaps, or similar provisions in the design of nearby land uses.

This degree of hazard abatement, i.e., the complete elimination of land use hazards associated with dangerous cargoes, would entail either total development prohibition or highly stringent and costly design requirements for all lands adjacent to local freeways and railways (very wide buffers between right-of-ways and development, diking stream enclosures, removal of existing roadside storm drains, etc.). In light of the very low frequency of hazardous cargo mishaps experienced throughout the county to date and likely to occur in the future, the adoption and implementation of such strict general plan provisions would be highly infeasible in terms of cost versus benefits, especially in areas which are already urbanized.

On the other hand, this safety element should and does recognize that the possibility of a transport mishap involving hazardous cargoes is present in the planning area. Certain provisions included in this general plan primarily in response to noise and visual issues will have the secondary effect of protecting land development near freeways and main railroad alignments from casualties or property damage due to mishaps involving hazardous cargoes. The plan provisions are those stipulating increased development setbacks and berming techniques for the purposes of noise and scenic buffering. Specifically, these provisions include the following:

In the Health and Safety Element under Noise, provisions 3 through 6 on page 22, and 7 and 2 on page 23.

In the Scenic Roadways Element, provisions C/D 4 and E2, page 11; E12, page 12; H5 and J2, page 14; and 3a, page 15.

IMPLEMENTATION METHODS

GENERAL PLAN MODIFICATIONS

Where lands currently designated as "extensive agriculture" overlap areas identified in this element as highly unstable (Type A lands) or highly fire-prone (extreme wild-fire risk areas), general plan modifications should be considered to discourage residential uses. "Extensive agriculture" provisions of the county and city general plan now allow residential development on 20 acre parcels.

Lands identified as Type A lands overlap with current intensive agriculture land use designations at the uppermost reaches of Pleasant Valley Road (west side), in the English Hills east of Putnam Peak, and along Twin Sisters Road in the vicinity of Suisun Reservoir.

Lands identified as extremely wildfire prone overlap with extensive agriculture land use designations throughout the Vaca Mountains, in the uppermost reaches of Green Valley, in Jameson Canyon, and in American Canyon on the south side of I-80.

There is currently no general plan language nor supporting zoning regulations, discouraging 20 acre residential development in these areas as a primary use. Current plans should be revised to stipulate that no new residential construction shall be allowed to overlap Type A and extreme wildfire risk lands unless it can be conclusively demonstrated to be auxiliary to an extensive agricultural use. In addition, the real agricultural value of these highly hazardous lands, particularly those of severe slope instability, should be reconsidered to determine whether an open space classification requiring larger parcel sizes in the range of 50 to 100 acres is more appropriate.

Other current general plan land policies should also be reconsidered by the county and cities where they may be in conflict with areas identified as extremely hazardous. For example, the following use designations may overlap areas identified herein as highly landslide prone Type A lands and therefore should be considered for conversion to a use which would not exceed the use limitations called for in this element (an exact determination of conformity is difficult due to the generality of the GP mapping):

- a. "Suburban density" residential designations (2 d.u.'s/acre) north of Vacaville to Gibson Canyon Road and Browns Valley Road (Vacaville General Plan)
- b. "Estate density" designations (1.5 d.u./acre) along the upper reaches of Rockville Road in Green Valley (Cordelia Area Specific Plan)
- c. "Regional/highway commercial" designation southeast of the I-80/Suisun Valley Road intersection (Cordelia Area Specific Plan)

In addition, current general plan designations at the following locations may overlap areas identified in this element as extremely or highly wildfire prone:

- a. "Suburban density" designations (2 du/acre) in the vicinity of Foothill Drive and Pleasants Valley Road overlap highly fireprone lands (specific policies in this element for high wildfire risk lands stipulate that densities shall not exceed 5 acres per dwelling unit).
- b. "Low density" residential designations (2.5 d.u.'s/acre) along the west side of Suisun Valley Road at Rockville overlap extreme wildfire risk lands (specific policies herein stipulate that no residential development shall be allowed here)
- c. "Intensive agriculture" designations (2.5, 5, and 10 acres/d.u.) overlap extremely wildfire prone lands along the upper reaches of Suisun Valley Road. This current general plan designation should be reconsidered in terms of the agricultural value of this land as compared to the risk potential. Perhaps a more extensive agricultural use allowing residential construction only as an auxiliary use would be more appropriate.

REGULATORY METHODS

As a primary means of implementing the specific land use policies set forth in this element, the county and cities should expand their regulatory programs to include the following specific ordinance and procedural requirements:

MANDATORY PLANNED UNIT DEVELOPMENT

Those planning area lands which have been identified as subject to hazardous development constraints and in need of further site investigation and possible hazard abatement measures before safe development can be assured, cannot be adequately dealt with under normal zoning and subdivision procedures. Therefore, any subdivision or lot split submittal which includes lands identified in this element as in the Type B slope instability category, as subject to high wildfire risk, or as within noise contour bands (current or projected) exceeding 60 dBA, should be made subject to mandatory planned unit development procedures.

SPECIFIC PLAN PROVISIONS

The state authorized specific plan technique provides the county and cities with an alternative regulatory measure to mandatory planned unit development. Specific area planning can be employed to insure that proposed development layouts adequately consider hazards

to safe development and natural resource values. The technique is particularly appropriate for larger development sites with a complex variety of natural and man-induced conditions and land use needs. Specific plans may include, but are not limited to controls on grading, building, building location, density, drainage, wildfire and flood protection, noise abatement, open space, circulation and access, landscaping and landscape preservation, public facilities, and natural resource protection. The specific plan is, in effect, a publically prepared and adopted planned unit development proposal.

✓ LAND CAPACITY ORDINANCE

An effective means of relating allowable density to the specific characteristics of a site is through enactment of a land capacity ordinance. The purpose of such a regulation would be to ensure that the level of development permitted is based on the actual amount of buildable land and not on gross acreage. The ordinance would require documentation of a site's soil, geologic, seismic, hydrologic, slope, fire, and natural resource conditions and a determination, based on these factors of what portion of the site is safe and buildable. Additionally, other on- and off-site factors could be included in the calculations to determine allowable density and structure placement. The potential for natural disruption of roads, water and power lines, and emergency vehicle access would be a principal consideration in the density calculations.

NON-URBAN USE ZONES

The county zoning ordinance should be amended to include a new zone which places further restrictions on parcel size and residential use. Such a non-urban use zone could then be applied to lands including those now designated for extensive agriculture use which fall within Type A slope instability areas or extreme wildfire risk areas. Residential development would be prohibited in a non-urban use zone except as auxiliary to an agricultural or recreational use.

✓ GRADING AND DRAINAGE ORDINANCE

The county and cities should enact a grading and drainage ordinance which would require special excavation precautions to minimize hazards in areas of slope instability, limit grading to those operations which would enhance ground stability without drastic site alteration, require special surface and subsurface drainage provisions, require that grading restore rather than disrupt natural patterns and volumes of surface runoff, and limit the construction of impermeable surfaces (structures, patios, roads, etc.) over naturally permeable soils and geologic areas.

SUBDIVISION ORDINANCE REVISIONS

County and city subdivision ordinances should be amended to incorporate specific data and design requirements related to surface faulting, ground failure, flooding, and noise.

FIRE ABATEMENT ORDINANCE

In order to minimize fuel buildups in fire-prone areas, an ordinance should be enacted by the county and cities which would require private property owners in areas subject to wildfire and grassfire risk to periodically thin vegetation, clear underbrush, and maintain on-site fuel breaks.

CREEKSIDE ORDINANCE

The county and cities should enact a creekside ordinance for application to creek shoreland areas. The ordinance would override underlying zoning so as to protect both upstream and downstream shoreline and backshore areas from environmental and property damage resulting from creek encroachment by new development. Regulations should be provided to mitigate downstream flooding, avoid any upstream flood hazards, prevent hazards due to seismic induced lurching, provide access for channel maintenance, and protect natural riparian habitats. The ordinance should establish a shoreline zone of perhaps 25 feet parallel to the creek and a backshore zone of perhaps 150 feet upslope from the boundary of the shoreline zone. Provisions can then be formulated which set the uses permitted in each overlay zone as well as specific standards and criteria for development within the zones.

BUILDING CODE AMENDMENTS

In addition to the latest edition of the Uniform Building Code, the county and cities should enact additional building standards including special foundation requirements and further grading restrictions for lands identified as unstable, special measures to resist seismic loadings, added foundation requirements for liquefiable and expansive soils, special limitations on exterior building materials in wildfire risk areas, specific flood-proofing measures for construction in flood-prone areas, and accoustical design measures for noise-sensitive structures.

NOISE REGULATIONS

Implementation of noise abatement policies requires two types of regulatory responses. The first response should consist of adding noise performance standards to existing zoning provisions. It is recommended that general provisions be added to the zoning ordinances establishing three levels of permitted noise emission by stationary sources. The most permissive level would permit 75 dBA CNEL at the property line and would be applied pri-

marily to heavy manufacturing zones. The next would allow up to 60 dBA CNEL at the property line and would be applicable for most office, general retail and light manufacturing zones. The most restrictive provisions would limit emission to a level not greater than 50 dBA CNEL at the property line. These latter provisions would apply primarily to residential areas but could also be applied in other special circumstances such as to areas adjoining hospitals and schools. Additionally, general provisions should be added to the zoning ordinance which would prohibit any uses from emitting noise which, as measured at the property line of any lot in an adjoining or nearby zone with more restrictive noise requirements, would exceed the standard set for the adjoining or nearby zone (see Table 1). These noise standards would be administered as a part of the regular zoning and building permit application process. The applicant would be responsible for ensuring compliance with the standards.

The second type of response should be enactment of a noise ordinance which would regulate mobile or short duration types of noise emissions or noise generated by added equipment which does not require zoning approval or a building permit. Types of problems covered by such provisions include on-site vehicular operations such as truck loading and unloading, operation of construction equipment and amplified music. Enforcement of such noise abatement provisions would generally be done on a complaint basis.

EIR PROCESS

Coordinating Environmental Impact Assessment, Subdivision or P.U.D. Map Submission, and Land Capacity Ordinance Procedures

The state-mandated EIR process can be used as a means of coordinating and integrating various development review procedures into an internally consistent regulatory process organized for efficient use and administration. Such a coordinated development review process offers advantages both to developers and to local planning staffs. The following EIR process is recommended:

1. Data requirements which are necessary in preparing the "existing environment" portion of an EIR shall be met through the subdivision or P.U.D. ordinances as described in this section which should require the applicant to provide specific data requirements pertaining to natural resource values including vegetative and animal habitats, hydrology, slope conditions, and scenic resources; hazards including slope instability, seismicity, flooding, fire, and noise; and public service and facility needs generated by the proposed development (on- or off-site roads and utilities related to or potentially affected by proposed development, schools, police, fire, park, and recreation facilities).
2. The above data on natural resources and hazards shall also provide the applicant with the basis for applying land capacity ordinance provisions to determine the permitted level of development. This determination should be reviewed by county or city staff before the applicant proceeds with preparation of his tentative map.

3. After the above data has been gathered and an allowable level of development has been determined, the applicant shall then submit his tentative maps to the county or city. The maps must be accompanied by documentation of the development alternative(s) considered and an explanation of why the submitted scheme has been selected. The submission must include documentation of the impacts associated with each alternative. (This requirement should be sufficient to meet EIR requirements for considering project alternatives.)

4. The county and city staff or an EIR consultant selected by the county or city shall review the applicant's tentative map submittal and shall determine (a) if the environmental analysis is adequate; (b) if reasonable alternatives have been considered, i.e. those which would eliminate or minimize identified adverse impacts; and (c) if the documentation of impacts is complete. In the event that any of the above are incomplete, the county or city would authorize either the applicant or EIR consultant to undertake any necessary additional work. If the EIR is found adequate, or following any additional work required to meet EIR requirements, the staff or consultant will prepare the draft EIR incorporating any plan modifications, design changes, or other conditions considered necessary to mitigate adverse impacts.

5. The required hearing for the tentative subdivision or P.U.D. map would be held jointly with the E.I.R. hearing and the application approved subject to whatever conditions are considered essential.

6. The final map would be submitted for staff review to determine compliance with adopted provisions. Final approval could then be granted.

Coordination of the General Plan and the EIR Process

The General Plan provisions of this section have identified specific EIR assessment requirements which must be met in various parts of the County. Briefly these include:

- a. Detailed site analysis requirements of development proposals including Type B lands (soils, geologic, and seismic data).
- b. Detailed site analysis requirements for major development proposals falling within one quarter mile of a fault (fault location and activity data, hazard mitigation measures).
- c. Site investigation requirements for all projects proposed for areas identified as underlain by liquefiable soils.
- d. Dam safety investigation requirements for development proposals which fall within the potential inundation area of a levee or canal.
- e. Detailed noise analysis requirements for development proposals within certain noise level contour areas.

GOVERNMENTAL PROCEDURES

SPECIAL ASSESSMENT DISTRICTS

The county and cities should assign their legal council the task of establishing more precisely the authority for use of special assessment procedures for following planning and landslide damage contingency purposes:

Special Planning District

Special assessment district procedures might be applied by the counties and cities to finance specific planning area activities. Where the specific area plan process is considered to be an appropriate technique for a particularly large and complex site, the site could be temporarily designated as a special assessment district for (a) the specific purpose of funding the planning effort or (b) the purpose of funding public improvements and any related planning efforts. The latter may be a more legitimate basis under present law for forming a special assessment district primarily to fund a specific area planning effort.

Special Landslide Prevention and Maintenance District

For the purpose of relieving the community-at-large from the burden of maintenance and repair costs due to landslide damage to public facilities in an area of Type B lands (subject to slope instability problems), present legislation might enable the county to require the formation of a special maintenance district as a condition of a major development approval. Although no provisions for the formation of special districts specifically for landslide-related maintenance purposes currently exist, such use of special assessment procedures may be allowable under county service area, community services district, or other special district provisions related to maintenance of public roads and utilities.

With the requirement for the formation of a special landslide assessment district as a condition of major development approvals on Type B lands, assessments could then be made on the development itself (property owners) if and when landslide damage to public facilities occurs, or to finance preventative measures.

JOINT DATA COLLECTION PROGRAM

The county and cities should jointly initiate a geologic and seismic data collection program to accumulate data relevant to development review and planning purposes. Any data collected on faults in proximity to developing areas could then be mutually shared. A duplicate file should be established in each of the participating planning departments. Reference to the file should be required as part of normal development review procedures.

Where file data becomes sufficiently detailed and adequate, certain investigation requirements in regard to a particular site could be waived.

JOINT SEISMIC SURVEYS

The county and cities should individually or jointly investigate the possibility of contracting with the State Division of Mines and Geology, or the U.S. Geological Survey, for special studies to determine seismic activity and associated hazards of active and possibly active faults that traverse the planning area.

JOINT CONSULTANT ASSISTANCE PROGRAMS

The county and cities could execute a joint contract on a part-time basis with private consultants to achieve needed capabilities for expert review of required soil, geologic, seismic, dam, and noise investigations; or the county and cities could establish a joint staff position to aid both the county and cities.

COUNTY FLOOD CONTROL DISTRICT

The County Flood District should be expanded to assume a leadership and coordinating role to realize an integrated areawide flood control program. Such a program could ensure that flood control is approached on an integrated upland-lowland, watershed basis. The County Flood Control District is the appropriate body to coordinate all county and municipal public works flood control efforts as well as inter-county efforts which involve the same watersheds.

EXISTING CONDITIONS

In previous pages, a set of specific plan policies and related implementation techniques is provided that responds to certain seismic, geologic, hydrologic, fire, and noise conditions which act as development constraints within the planning area. In this section, these conditions are defined and located in greater detail and an explanation of how each acts as a constraint to safe land development is provided.

SEISMIC AND GEOLOGIC HAZARDS

SLOPE INSTABILITY

Landslides, land slips, mudflows, and debris flows have been the subject of numerous studies in the San Francisco Bay region. In this geologically young area, continued uplift of the Coast Range Mountains has resulted in widespread susceptibility to mass movement, particularly in upland areas. The use of aerial photos to map landslides has shown that these mountainous areas are frequently covered by massive landslides a mile or more in length. The age of these giant landslide features is not well known, but some of them probably originated during a period of greater rainfall several thousand years ago. Despite their age, these large landslides are generally quite unstable, and can be reactivated by grading operations or other development activities.

Landslide susceptibility is a function of various combinations of factors including rainfall, rock and soil types, steepness of slope, slope orientation, vegetation, seismic conditions, and works of man. Currently, the U.S. Geological Survey is preparing a slope instability map based on the fact that landslides occur most often on slopes steeper than 15 percent, in areas with a history of landsliding and in areas underlain by certain geologic units. This work (as yet unpublished) has been used in preparing Figure 10, a relative slope instability map for Solano County. The USGS map divides the area into six slope stability categories ranging from generally stable, to highly susceptible to slope failure. The three most hazardous categories are shown on Figure 10. A brief description of all six categories is presented here, along with the distribution of each category throughout the planning area.

Category 1: Areas of 0-5 percent slope which are not underlain by known landslide deposits or other deposits known to be unstable at low slope angles. Although generally stable, locally steep slopes (such as along water courses) may be susceptible to slope failures. Category 1 consists primarily of the floodplain area between the Montezuma Hills and Putah Creek.

Category 2: Areas of 5-15 percent slope that are not underlain by landslide deposits or other deposits highly susceptible to slope failure on moderate slopes. Category 2 lands are found throughout the western half of the planning area, but especially in the Vallejo/Benicia area and east of the English Hills.

Category 3: Areas of greater than 15 percent slope which are not underlain by landslide deposits or other bedrock units that are susceptible to landsliding. This category is generally stable, but may include small unmapped landslides or small areas of unstable bedrock. Most of the Vaca Mountains (including Cement Hill) are in Category 3. Other areas in this category are between Suisun and Green Valleys, and northwest of the English Hills.

✓ Category 4: Areas of greater than 15 percent slope that are underlain by bedrock units which are highly susceptible to landsliding, but are not underlain by landslide deposits. The English Hills, the highlands between Vallejo and Benicia, the Potrero Hills and hills northwest of Fairfield all have large areas of Category 4 land.

Category 5: Areas of 0-90 degree slope which are underlain by or immediately adjacent to landslide deposits. These areas include many types of terrain, but most commonly are fairly steep hillsides underlain by bedrock which is highly susceptible to landsliding. This category also includes some small or narrow (less than 1000 feet wide) areas not underlain by landslides. Category 5 lands exist mainly in the mountains west of Green Valley from Columbus Parkway and Lake Herman Road to Wild Horse Creek. Another area dominated by landslide deposits is east of Twin Sisters and west of Suisun Valley. These two areas contain many very large landslides, and represent the greatest concentration of landslides in the county. Other hillsides are not free of this problem, however, and slope failures have been mapped in both the English Hills and the Vaca Mountains (including Cement Hill).

Slope instability results in the loss of millions of dollars annually in the nine Bay Area counties. Taylor and Brabb (1972), in a U.S.G.S. study, showed that over \$25 million was lost because of landslide damage in the Bay Area during the winter of 1968-69. Although this cost is somewhat higher than the annual average because of unusually high rainfall, similar amounts of rainfall can be expected to fall at least once a decade, and these may cause widespread landsliding. The planning area has had a history of relatively low dollar loss from landsliding due to the lack of large-scale development intrusion into hillside areas, a situation which is subject to future change as indicated in Figure 11.

Landslide damage varies according to the type of slope failure which occurs. When private homes are involved in landsliding, they often become total losses to their owners since resale value is greatly reduced by demonstrated conditions. Mudflows may do only minor structural damage, but because of their rapid movement, they are

FIGURE 10

SLOPE INSTABILITY CATEGORIES

Note: A large blackline print of this figure has been submitted separately with this preliminary draft. Subsequent to staff review and approval, the figure will be reduced to 11" by 17" and included here with the final draft of this element.

capable of trapping or burying people, and seriously damaging landscaping, building interiors and parked automobiles. Even when structures themselves are sited on stable bedrock, landsliding and small land slips can present problems for access roads and utility maintenance. Slope failures can also cause blockage of water courses and resulting flood damage during months of high flow.

Seismic conditions can intensify slope instability problems, particularly if shaking occurs when the ground is wet. Even moderate earthquakes can cause slope failures. For example, a Magnitude 5.3 earthquake that occurred in San Francisco in March of 1957 triggered a number of slides along the coast, blocking State Highway 1. The maximum intensity of this earthquake was only VII on the Modified Mercalli Scale (see Appendix A). Within the planning area, the hills near the active Green Valley fault are especially prone to seismically induced landsliding due to their proximity to a potential epicentral area. This proximity to an active fault may be partly responsible for the very large number of landslide deposits that exist there at the present time.

SURFACE FAULTING

Geologic evidence indicates that the planning area is laced with a number of faults - fractures or fracture zones in the earth's crust along which there has been displacement of the two sides relative to one another parallel to the fracture. The displacement may be a few inches to several feet. Cumulative displacement through geologic time may reach miles.

If any surface displacement in excess of an inch or two along one of these faults were to occur beneath a building, transportation facility, main utility line, aqueduct, etc., the effects could be catastrophic. Therefore, it is important to know the relative likelihood of future movement along these faults and to plan accordingly.

Known planning area fault traces are shown on Figure 1. Some are considered active, i.e., capable of displacement in the near future. Others, although not recognized as active, must be considered as potentially active until they are investigated more closely.

Active Faults

An active fault is one along which historic movement has been documented. Active faults are recognized by the following criteria:

1. Historic fault movement
2. Displacement of Holocene deposits (soil or rock materials less than 10,000 years old)

3. Evidence of fault creep -- slow ground displacement without accompanying seismic events
4. Seismic activity along fault plane
5. Displaced survey lines
6. Geomorphic evidence -- e.g., offset stream courses, sag ponds, scarps, fault troughs and fault saddles

At present, segments of only two planning area faults are known to be active: the Green Valley fault and Concord fault (see Figure 1). The trace of the Concord fault trends northwestward through the City of Concord into Solano County, just northeast of Benicia. It has been studied in detail by Robert Sharp (1973) who documented right lateral creep along the fault trace. In 1955, an earthquake of Magnitude 5.4 occurred on the Concord fault, causing population centers in the planning area to experience intensities of V-VI (maximum intensity at the epicenter was VII). This was sufficient to break windows and glassware and crack plaster. (See Appendix A, p.75, for a detailed description of Modified Mercalli Scale.)

The Green Valley fault has been the focus of recent studies by the State Division of Mines and Geology (Dooley, 1972) and is currently being investigated by the U.S. Geological Survey. This fault trends northwestward along the eastern front of the Benicia Hills and appears to have right lateral offset (Dooley, 1972), which means that the western side has moved northward relative to the eastern side, or vice versa. The fault shows many features associated with recent activity including offset fences and power lines, location of microearthquake epicenters along the fault trace, scarps in Holocene alluvium, disrupted drainage patterns, and a conspicuous alignment of topographic depressions and saddles.

The Green Valley fault has also been investigated by a number of consultants in connection with development projects in Green Valley. These investigations have included trenching and geophysical surveys, and have provided additional evidence of recent activity. Although the fault can be traced from Suisun Bay northward across the county line, definitive evidence of activity is lacking north of where it crosses Green Valley Creek. The heavy vegetative cover in this area makes both aerial photographic and field studies difficult. Both the Concord fault and the Green Valley fault (south of the Green Valley Creek crossing) have been designated as active faults by the State, and have been included in Special Studies Zones under the Alquist-Priolo Geologic Hazards Zones Act (Chapter 7.5, Division of Public Resources Code). The zone of actual rupture on a fault is generally small compared to the area which is subjected to severe ground shaking. Displacement along the Green Valley fault could be as much as $2\frac{1}{2}$ feet for an earthquake of Magnitude 6+. It is possible to greatly reduce damage due to such fault rupture by avoiding construction on active fault traces.

Areas of special concern associated with these potentials for surface faulting and major transportation and transmission routes in the study area are mapped on Figure 12. Fault rupture along the Green Valley fault can be expected to cause damage to Interstate 80, State Highways 12 and 21, and the Southern Pacific Railroad line through Cordelia. Freeway overcrossings may be displaced or may collapse as a result of fault movement. Designated county evacuation routes to the south, Highways 80 and 21, should not be relied upon as post-earthquake routes since they are subject to blockage by earthquake-induced damage or collapse.

A number of water, gas, and oil pipelines cross active segments of the Green Valley fault within the planning area and could create flooding, fire, and pollution problems if earthquake-induced rupture were to occur. There are several ways, however, to reduce the hazard of pipeline rupture. Smaller fault displacements can be accommodated by expansion joints or flexible piping at fault crossings. New oil, and water mains are often provided with this or similar features when laid across a known active fault. Natural gas, oil, and water pipelines are often equipped with pressure-operated shutoff or block valves that stop transmission when there is free flow somewhere in the line.

The Southern Pacific Pipeline Co. (Main Office, Los Angeles) has two pipelines that cross the Green Valley fault, paralleling the S.P. Railroad alignment from Suisun City to Benicia. These are both petroleum pipelines, one seven and one ten years old. The block valves nearest to the Green Valley fault crossing are at Benicia to the south and Suisun City to the north. No automatic valving is used on these lines.

Pacific Gas Transmission Company operates three major gas transmission lines which cross the Green Valley fault. A ten inch line to Marin and a 16 inch line to Sonoma have been laid westward from Cordelia through Jameson Canyon. A third pipeline brings gas to Vallejo from the two other lines in Cordelia. Block valves at the company's Cordelia Regulation Station can shut off flow to all lines crossing the fault. Valves on the other side of the fault are located two miles west of Cordelia, in Jameson Canyon, and about six miles south of Cordelia.

Although some of these pipelines also cross the Suisun Marsh, no special precautions have been taken to avoid rupture there due to liquefaction or ground shaking. PGT engineers reportedly have had no problems with their pipelines through soft soils other than a tendency for them to rise to the surface. The flexible nature of the steel piping apparently prevents leaking and they are simply reburied.

The alignment of the Green Valley fault with the Concord fault strongly suggests that they are strands of the same fault. If the two faults are considered together, then the magnitude of earthquake which might be expected from the fault system will be greater than that from either one alone. Therefore, these faults are listed both separately and as a single fault in Table 5, which lists all known active faults near Solano County and

the potential for damage in the county. The location of these faults is shown in a regional context on Figure 13.

Faults of Unknown Activity

Although other faults in the county are not considered active, it should not be assumed that all of them are inactive. Often faults are not recognized as active until the urbanization process allows them to be looked at more closely. For example, the accurate determination of microearthquake epicenters requires a sufficient network of seismograph stations around the area of interest. But such networks are usually installed in high-priority areas where earthquake research is important; i.e., in urban areas of high seismicity. Within the last two or three years the National Center of Earthquake Research (a branch of the U.S. Geological Survey) expanded their detection network to include most of southern Solano County. When current investigations are published, the pattern of microseismic activity within the county may suggest other faults that could be active.

Leighton and Associates (1975) has considered the Franklin and Southhampton faults to be potentially active because their trend and sense of movement suggest that they may be part of the Calaveras fault system. They have recommended more detailed study of these and several smaller faults in the Vallejo area. Within the planning area there are several other faults that could possibly be active, such as the Vaca Valley fault, the Kirby Hills fault, and the Lagoon Valley fault. The Midland fault is a fault whose activity is also unknown. It was discovered by oil and gas explorations in the eastern part of the county. It represents a displacement of rocks 3000-4000 feet below the surface, but has no known surface expression. If this fault were to prove active and an earthquake were to occur on it, surface rupture would be unlikely, but considerable damage from ground shaking could be expected.

SEISMIC SHAKING

Earthquake-generated ground shaking is by far the greatest single cause of earthquake damage. Solano County has had a history of earthquake shaking which goes back more than 150 years. Important historic earthquakes are tabulated in Tables 6 and 7 which follow.

TABLE 5. ESTIMATED POTENTIALS FOR STUDY AREA EFFECTS FROM REGIONAL SEISMIC ACTIVITY

Fault Source	Fault Location	Historic Earthquakes	Max. Probable Richter Magnitude	Est. Intensity in Solano Co. (firm ground)	Probable Effects in Solano County
San Andreas fault	38 miles SE of Fairfield	Great San Francisco earthquake Mag.=8.3	8+	VI-VII	Frightens everyone. Heavy furniture moves or overturns. Some glass breakage. Slight damage to modern buildings on firm ground. Heavy damage to masonry structures on poor ground. Local ground failure in marshy or river bank areas.
Hayward-Healdsburg-Rogers Creek fault system	24 miles SE of Fairfield	1836 and 1868 Hayward earthquakes Mag.=7+	7+	VI-VII	Similar to effects of San Andreas earthquake.
Green Valley fault	Fault passes through Green Valley in western part of county, 8 mi. west Fairfield	Microearthquake activity only	6+	VIII-IX near (within a mile or two of) Green Valley fault; VII in SW part of county including Fairfield. V-VI elsewhere.	Moderate to severe damage to existing or new structures in SW part of county. Landsliding and liquefaction in SW part of county. Moderate damage elsewhere in county.
Calaveras-Concord fault system	14+ miles south of Fairfield	1961, on Calaveras, Mag. 6-7 1955, Concord, Mag. 5+	6+-7+	VI Possibly VII in delta area.	Similar to effects of San Andreas or Hayward quakes.
Unidentified fault(s) in eastern half of county	East of Vaca mountains (?)	1892 Mag. 6-7+	7+	VIII-IX	Moderate to severe damage in central part of county with ground failures on hillsides, along creek banks or in marshy areas. Water may be thrown out of canals and streams.

TABLE 6. STRONG EARTHQUAKES (ESTIMATED MAGNITUDE EQUAL TO OR GREATER THAN 6 3/4) WHICH HAVE ORIGINATED NEAR SOLANO COUNTY

Date		Epicentral Area (Earthquake Fault)	Maximum Intensity (MM) [*] In Epicentral Area
June 9-10	1836	East San Francisco Bay (Hayward fault)	IX-X
June -	1838	San Francisco/San Mateo Co. (San Andreas fault)	IX-X
Oct. 8	1865	Santa Cruz Mountains (San Andreas fault)	IX
Oct. 21	1868	East San Francisco Bay (Hayward fault)	X
April 19	1892	Vacaville (unknown fault)	IX
April 21	1892	Winters (unknown fault)	IX
April 18	1906	San Francisco (San Andreas fault)	XI

See Appendix A, page 75, for an explanation of the Modified Mercalli (MM) Intensity Scale

TABLE 7. OTHER STRONG EARTHQUAKES (MAXIMUM INTENSITY EQUAL TO OR GREATER THAN VII ON MODIFIED MERCALLI SCALE) WHICH HAVE ORIGINATED WITHIN 50 MILES OF SOLANO COUNTY

Date	Epicentral Area (Earthquake Fault)	Maximum Intensity (MM) In Epicentral Area
June 21, 1808	San Francisco	VII (?)
Feb. 15, 1856	San Francisco	VII
Nov. 26, 1858	San Jose	VIII
July 3, 1861	Amador Valley (near Livermore)	VIII
May 19, 1889	Collinsville/Antioch	VII
July 31, 1889	San Francisco Bay	VII
Oct. 11, 1891	Napa/Sonoma	VII-VIII
Mar. 30, 1898	Mare Island	VII
May 19, 1902	Elmira/Vacaville	VI-VII
June 11, 1903	Niles	VII
Aug. 2, 1903	San Jose	VII
Oct. 23, 1955	Concord	VII
Oct. 1, 1969	Santa Rosa	VII-VIII

See Appendix A, page 75, for an explanation of the Modified Mercalli (MM) Intensity Scale.

It is clear from Tables 5, 6, and 7 that Solano County is in an area of relatively high seismicity and will be subject to earthquake shaking in the future. No part of the planning area will be free from the effects of seismic shaking. Earthquake-triggered landslides, addressed earlier, are a potential major problem which can be induced by only moderate shaking. Ground failure in the form of soil liquefaction, lurching, and settlement, could also result from shaking (addressed under GROUND FAILURE). Flood damage from earthquake-induced dam failure, canal and levee damage, and tsunami are also seismic shaking-related threats to existing and future urbanization (see FLOODING).

Depending upon the magnitude, proximity to epicenter, and subsurface conditions (bedrock stability and the type and thickness of underlying soils) present at a given point beneath the surface of the planning area, shaking damage which can be expected to occur in the next few decades will vary from slight to intensive. For example, the wet unconsolidated soils of the Suisun Marsh would have a high ground response, while areas of hard rock generally would experience lower intensities of shaking, but would be subject to other earthquake-induced hazards such as landsliding. The peat and organic soils of the delta would experience large scale amplification of seismic waves. Structures located in these areas would be subject to severe shaking during an earthquake.

Different types of structures are subject to different levels of ground-shaking damage. Conventional one and two story wood-frame residential structures generally have performed very well during strong earthquake ground shaking. Collapse or total destruction of wood-frame homes is rare, even during strong earthquakes, except in cases where these structures are affected by ground rupturing or landsliding, or are affected by extremely high ground acceleration. For example, several famous photographs taken after the great 1906 earthquake show wood-frame homes standing intact and apparently undisturbed just a few feet away from the main scar of ground rupturing along the San Andreas fault line.

Studies of more recent earthquakes show that the following types of structural damage from earthquake shaking can be expected to occur to some modern wood-frame homes of the type found in Solano County:

1. Possible shifting of homes on foundations. This problem has been minimized in recent years by requirements that adequate structural connection between house frame and foundation be provided.
2. Damage to masonry chimneys or facades. Damage or toppling of unreinforced brick walls or chimneys commonly occurs in strong ground shaking. Code-required reinforcement and chimney ties can help minimize damage, but will not prevent it completely.
3. Falling of unbraced water heaters, with possible fire hazard.

4. Cosmetic damage, especially cracking of plaster, and some glass breakage.

Damage to unconventional "custom" type houses is often more severe in earthquakes.

Not surprisingly, the damage ratio, expressed as a percentage loss of value to the "average" residential area due to an earthquake, becomes higher with increasing intensity of ground shaking. Studies with estimates applicable to typical Bay Area conditions suggest that the damage ratio associated with various intensities of shaking would be approximately as follows:

<u>Intensity</u>	<u>Damage Ratio, %</u>
V	0.1
VI	0.5
VII	2.5
VIII	8.3
IX	12.1

Thus, a rough estimate of the levels of housing damage expected in the planning area in a great earthquake, with intensity values of VIII-IX, would be on the order of 10 percent of the value of all housing.

Commercial and industrial buildings are more difficult to classify than tract housing because of the variety of building types found in the planning area. In the older areas, one and two story wood frame and stucco structures could be expected to show fair performance in earthquakes. Old unreinforced masonry buildings, however, particularly those constructed prior to 1933 (when improved building codes were adopted in California), are not resistant to earthquake shaking and may be severely damaged during strong shaking. The fall of decorative masonry parapets and cornices sometimes found on such buildings has been a major cause of injuries during previous quakes.

A small number of pre-1933 masonry buildings in the planning area may present public safety hazards during seismic shaking, since they were constructed prior to seismic-related revisions to the building code. An intensity value of VIII - IX on the Modified Mercalli Scale will probably cause partial or total collapse of at least one or two of these structures. Two-story masonry buildings are particularly susceptible to major damage and collapse during an earthquake. Such two-story buildings are present in central Vacaville on the south side of Main Street, in central Suisun City on the west side of Main Street, and less significantly (one example), in central Fairfield on the north side of Texas Street (see Figure 1).

With regard to newer buildings, single story wood-frame or tilt-up construction has generally sustained only moderate damage during earthquake shaking, although recent experience in San Fernando suggests that minimum code requirements with respect to roof-to-wall connections in tilt-up buildings may not be adequate to assure public safety, especially in high-occupancy commercial buildings. Hence, roof or wall collapse must be considered a possibility in at least a minority of tilt-up buildings during VIII-IX intensity shaking. During a strong earthquake, the damage and safety of tilt-up buildings in industrial areas would depend to some degree on the special structural design precautions and care in supervision of construction which had been provided to these buildings. This, of course, would depend mainly on the owner of the building, the county or city's responsibility being limited to a general plan check and spot inspection aimed at assuring conformance with minimum code requirements only.

Freeway and railroad interchanges in Solano County will be very susceptible to collapse as a result of earthquake ground shaking. The San Fernando earthquake of 1971 (Magnitude 6.6) resulted in the total or partial collapse of five interchange structures and damage to a number of others. Total structural damage to highways and bridges was estimated at \$9.5 million.

Lurch cracking is another phenomenon that occurs during earthquake ground shaking, and involves the horizontal movement of soil masses toward the open face of creek banks. Creekside homes are especially vulnerable to damage from lurch cracking.

Despite these generalizations, the extent to which a specific structure is damaged is a function of the design and construction quality of the particular building and the local soil conditions. The specific characteristics of shaking which can be expected at a given site and the reaction of a certain type of structure to such shaking must be determined on an individual basis by site investigation.

GROUND FAILURE

LIQUEFACTION

Soil liquefaction results from loss of strength during earthquake shaking. The most susceptible soils are clean, uniformly graded, loose, saturated, fine grained sands. The granular soil material is transformed by earthquake shaking into a fluidlike state in which solid materials are virtually in suspension, similar to quicksand.

The liquefaction of soils can cause them to move laterally outward from under buildings, roads, pipelines, transmission towers, railroad tracks, and other structures such as bridges. Damage is usually greatest to large or heavy structures on shallow foundations, and takes the form of cracking, tilting, and differential settlement. Where gentle slopes exist, such as on stream or slough banks, liquefaction may cause lateral spreading landslides. Whole buildings can be moved downslope by this type of ground failure. Where the condition is known to exist, proper structural and foundation design can usually minimize or eliminate liquefaction hazard to new construction.

Soil layers with high liquefaction potential are also present in the existing and former marsh areas of the county which are underlain by saturated bay mud. Furthermore, liquefaction potential in Solano County has increased in recent years because of a rising water table in many parts of the planning area. Portions of the planning area subject to liquefaction are shown on Figure 1. Areas of special concern associated with liquefaction potential and current land use policies and major utility alignments are mapped on Figures 11 and 12, respectively.

Prior to 1958, the primary source of agricultural water was from local wells drilled into the Tehama Formation, an extensive aquifer in the central and eastern parts of the county. However, by 1959, surface water from Putah South Canal was available at low agricultural rates, and many irrigation wells were abandoned. The cessation of pumping in agricultural areas has resulted in a dramatic ground water rise since 1959. Where these water conditions are combined with loose, fine grained sands, i.e., prime agricultural soils, liquefaction potential is high.

SUBSIDENCE

Other soils that present a development hazard are the subsidence-prone peat soils of the Suisun Marsh and the Napa River delta west of Vallejo which were drained in the early 1900's by the development of a levee system. When exposed to the air, these soils tend to oxidize. Oxidation lowers the elevation of these exposed areas by as much as .3 feet per year. The highly organic soils on Ryer Island and along Lindsay and Cache Sloughs are also subject to settlement and subsidence.

The question of subsidence due to gas withdrawal from the numerous natural gas fields scattered across the planning area is often raised, but if there is some subsidence attributable only to gas withdrawal, it is probably of minor significance in comparison to the degree of subsidence caused in gas field areas by peat oxidation. No concrete information on subsidence due to gas extraction within the county has been located.

SETTLEMENT AND SHRINK-SWELL POTENTIAL

Perhaps 20 to 30 percent of the planning area's flat land is underlain by soil having a high settlement or shrink-swell potential. Expansive or shrink-swell soils are those that contain significant amounts of clay minerals that swell when wet and shrink when dry. These clays tend to swell despite the heavy loads imposed by large structures. Damage (such as cracking of foundations) results from differential movement and from repetition of the shrink-swell cycle. In some cases, this problem may be avoided by removing the top soil layer before placing a foundation.

Soils having high shrink-swell potential in at least the top 12 inches are found throughout the county, especially in the eastern one-third, and are often referred to as "adobe" soils. Travis Air Force Base and the cities of Fairfield and Rio Vista are also largely underlain by expansive soil deposits. Although these soils can be an expensive nuisance, awareness of their existence prior to construction often means that the problem can be eliminated through proper foundation design. Appendix B is a short information sheet which can be distributed to building permit applicants to acquaint them with the problem.

Where appreciable thicknesses of bay mud underlie the extensive existing and former marsh areas of the county, sinking and differential settlement can occur leading to damage of structures sited on these lands. Damage due to such settlement can be overcome to a large degree by proper site preparation and foundation design. In general, however, development in these bay mud areas would probably involve fills and would have a high potential for building and road damage due to differential settlement. Failure of poorly constructed fills, or seismic liquefaction of the sand layers within the mud that the fills rest on, could result in substantial damage to roads and structures founded upon these fills.

FLOOD HAZARD

STORMWATER AND TIDAL INUNDATION

By far the major portion of flood-prone lands in the planning area, as shown on Figure 2, are subject to inundation due to heavy rainfall and resulting stream overflow. A number of streams in the planning area have long histories of seasonal flooding, often resulting in significant damage. Such floods can occur anytime during the rainfall months from November 1 through May 1. Flood risk is intensified in the lower stream reaches by the likelihood of coincident high tides and strong offshore winds during periods of heavy rainfall.

While floods of the recent past have been frequent and have caused significant damage to homes, businesses, crops, roads, etc.; they have not approached the disastrous results that can be expected with a relatively rare 100-year storm. The estimated inundation areas for such a 100-year flood event are also shown in Figure 2.

The potential for flood damage in the planning area is further aggravated by spreading urbanization which is having the combined effect of encroaching upon and reducing flood plain area in the low-lying areas while increasing the rates and volumes of runoff by overlaying higher lands (structures, paving, etc.), thereby restricting natural infiltration.

Fairfield-Suisun Area Conditions

Five streams which periodically overflow in the Fairfield-Suisun area are Ledgewood, Pennsylvania Avenue, Union Avenue, Laurel, and McCoy creeks. In the lower reaches of this creek system, flood hazards are intensified by high tides and resulting drainage restrictions. As a result, lowland floodwater ponding frequently does not drain for several days.

Floods have occurred in the Fairfield-Suisun area in 1950, 1955, 1958, 1966, 1967, 1970 and 1973. These floods have resulted in substantial losses to residences, businesses, crops, roads, etc. Furthermore, aforementioned investigations indicate that more severe meteorological conditions than those that have caused floods in the recent past could occur in the future, resulting in even greater flood damage. Accordingly, Figure 2 delineates the probable inundation area of a 100-year flood event.

Drainage improvements to provide additional protection for existing and future Fairfield-Suisun urbanization against the effects of seasonal flooding have been proposed by the U.S. Army Corps of Engineers in their "Fairfield Vicinity Streams" flood control project, scheduled for completion in 1977. The project would include a combination of channel improvements, diversion channels, drop structures, and the utilization of two existing detention basins.

In addition to the U.S. Army Corps of Engineers' proposed project, the City of Fairfield Department of Public Works has proposed a number of drainage improvements within the developed portions of the existing urban center, and where new development areas are designated in northern and western Fairfield.

Cordelia-Rockville Area Conditions

The potential for flood damage is also high in the vicinity of Cordelia and Rockville along the Green Valley, Dan Wilson, and Suisun creeks. These streams have a long history of flooding, particularly along the lower reaches of the Green Valley Creek

✓ which are influenced by Suisun Bay tides. The most severe flood conditions occur there when heavy rainfall coincides with high tides and offshore winds.

Floods have occurred in the Cordelia-Rockville area eleven times since 1937, or once every three to four years on an average. The largest and most damaging flood occurred in 1955 and was estimated to be a 40-year event. As mentioned earlier, investigations indicate that larger flood-producing storms should be expected in the future. The extent of inundation that can be expected to occur in the Cordelia-Rockville area from a 100-year flood is indicated on Figure 2.

Knowledge of the high flood potential and likely inundation areas around Cordelia and Rockville is particularly critical due to current land use pressures and policies in that area. Although development here is currently sparse, the area is expected to become one of the county's principal growth areas in the near future.

Major flood control and drainage systems have been proposed for the Cordelia-Rockville area in the "Water-Sewage-Drainage Element" of the Central Solano County General Plan (1974) as a guide for the future preparation of an engineering master plan for the area. The element recommends flood plain zoning, creek rechannelization, the construction of one or more retention basins, and special land treatments in the upper reaches of stream watersheds to minimize erosion and excessive runoff.

Vacaville Area Conditions

The Vacaville area is subject to frequent flooding from a number of creeks including Alamo and Ulatis creeks, the two major local watercourses; Encinosa and Laguna creeks which drain from the west into Alamo Creek; and Horse Creek and its several tributaries which drain the area east of the English Hills and ultimately flow to Ulatis Creek downstream from Interstate 80. Both Alamo and Ulatis Creeks drain the Vaca Mountains where rainfall intensity is relatively high, and flatten abruptly in the flat agricultural areas just above Pleasant Valley Road, often overspilling their banks and inundating lands north of town.

Floods have occurred in the vicinity of these Vacaville streams eleven times since the 1930's. The most severe and damaging floods took place in 1967 and 1973. And like other flood-prone areas in the county, these floods were not as extensive and potentially damaging as a flood generated by a 100-year storm would be.

Vacaville areas where flood risk is currently greatest are: (1) the North Orchard-Crestview area between Vaca Valley Road and the existing limits of development north of Hemlock School where development is now taking place, and (2) the Southeast Assessment District area in northern Vacaville, east of the English Hills, which is feeling pressures for development after recent sewer and water system installations.

The City of Vacaville in its Drainage Plan for Vaca Valley and Browns Valley Water Sheds (1974) proposes improvements to alleviate local drainage problems in these areas, but does not address major flooding problems relating to creek overflow.

All of the Vacaville area streams remain in their natural state as they flow through town. Downstream from I-80, channel improvements have been constructed which have helped to alleviate the flood problem in that area to some extent.

TSUNAMI AND SEICHE

Tsunamis are long-period ocean waves commonly caused by vertical faulting of the ocean floor. Such earthquake-associated waves (often erroneously called tidal waves) can cause considerable damage when they reach shallow coastal areas. Although Japan, Alaska, Hawaii, and California have all experienced damaging tsunamis during historic times, such waves do not reach the California coast very often. Ritter and Dupre in their 1972 U.S.G.S. Field Study (MF-480), estimate that the frequency interval of a tsunami with a 20 foot run-up at the Golden Gate is about once every 200 years. (The amount of run-up is the vertical height above still water level that the rush of water reaches.) A 30 foot wave might be expected once every 500 years. However, a study made in 1960 and 1964 indicates that a tsunami entering San Francisco Bay would be reduced in height by 50 percent as it passes Point San Pedro and by 90 percent before reaching the Carquinez Strait. The only areas of the county that would be subject to inundation by tsunamis, as shown on Figure 2, are the southwestern part of Mare Island and Island No. 1 southwest of Highway 37. The possibility of a tsunami being generated in San Pablo Bay (by the Hayward fault, for example) was also considered. But the shallowness of the Bay, and the predominant strike-slip motion of the active faults crossing the Bay, indicate that such an event is unlikely. Even if it were to occur, the resulting wave would not be high enough to inundate large areas.

A seiche is a stationary wave produced in reservoirs, lakes, and other closed or restricted bodies of water by ground shaking. The phenomenon is similar to the oscillations which result when a bowl of water is shaken. When they occur in large reservoirs, such waves can cause overtopping of dams, posing a serious threat to urbanized areas below. Areas subject to inundation due to such overtopping are, of course, the same areas as those shown in Figure 2 as subject to dam failure inundation.

DAM FAILURE

Senate Bill 896 (Government Code Section 8499.5), passed March, 1973, requires that the State of California Office of Emergency Services (O.E.S.) identify all dams in the state whose failure would cause injury or loss of life and prepare maps indicating the

inundation area assuming failure. Dam failure characteristics -- the potential rapidity and degree of failure and inundation -- are based on the structural type of each dam (earth, multiple arch, etc.).

The O.E.S. has identified ten such dams in Solano County as listed in Table 8. Inundation maps for the following nine county dams have been prepared and are summarized in Figure 2.

TABLE 8. PLANNING AREA DAMS (See Figure 2)

Name of Dam	Structural Type	Capacity (acre-feet)	Owner	Date of Construction
1. Fleming Hill No.2	Earth	34	City of Vallejo	1912
2. Lake Chabot	Earth	1120	City of Vallejo	1870
3. Lake Frey	Earth	1075	City of Vallejo	1894
4. Lake Herman	Earth	2210	City of Benicia	1905
5. Lake Madigan	Earth	1711	City of Vallejo	1908
6. Pennsylvania Creek	Earth	160	State Div. of Highways	1958
7. Pine Lake	Earth	360	City of Benicia	1942
8. Summit Reservoir	Earth	221	City of Vallejo	1968
9. Swanzy Lake	Earth	107	City of Vallejo	1931

An inundation map for the following county dam has not yet been submitted:

10. Putah Creek Diversion	Gravity	720	U.S. Bureau of Reclamation	1957
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Dams located inside the planning area, but declared exempt from the O.E.S. inundation mapping program since no injury or loss of human life is anticipated with failure, are listed below:

11. Bascherini Dam	Earth	19	Solano Irrigation Dist.	
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TABLE 8 (CONTINUED)

Name of Dam	Structural Type	Capacity (acre-feet)	Owner	Date of Construction
12. Dickson Hill Dam	Earth	23	City of Fairfield	
13. Giles Dam	Earth	119	Billy Yarbrough	
14. Green Valley Lake Dam	Earth	150	J.J. Willard	
15. Harris Dam	Earth	40	William J. McGuire	
16. Maine Prairie Dam #3	-	96	Maine Prairie Water District	
17. Mangels Dam	Earth	276	Lewis Mangels	
18. Municipal Dam	Earth	169	City of Suisun	

Dams located outside the county area which, with failure, would inundate planning area lands are:

19. Lake Curry	Earth	10,700	City of Vallejo	1926
20. Monticello Dam (Lake Berryessa)	Concrete Arch	1,600,000	U.S. Bureau of Reclamation	1957

Four of the dams listed above -- Lakes Chabot, Frey, Herman, and Madigan -- are relatively old and, if failure were to occur, could endanger population centers in the planning area. The county and cities affected may wish to obtain more detailed information on the stability of these dams from their owners.

Inundation maps for Monticello Dam at Lake Berryessa have not yet been submitted. However, since this dam retains one of the largest reservoirs in northern California storing 1,600,000 acre-feet of Putah Creek water, it is likely that extensive flooding of planning area lands would occur if this dam were to fail. Monticello Dam was constructed relatively recently (1957) and is considered to be seismically sound.

CANAL AND LEVEE FAILURE

Putah South Canal Conditions

The Putah South Canal is a potential source of earthquake-generated problems, including possible flood damage due to slumping, landslides and liquefaction (see Figure 12). Between Abernathy Road and Jepson Road there has been a problem with slumping and landsliding into the canal from the hillside areas to the north. Although in the past this has been primarily a maintenance problem, if a large landslide (perhaps triggered by earthquake shaking) were to block or rupture the canal during a period of high flow (i.e., summer), flooding would occur before repairs could be made. The Solano Irrigation District (S.I.D.) has already experienced one incident of total blockage and is aware of the potential problem. Although S.I.D. personnel were able to clear the canal within 24 hours, the blockage occurred during a period of relatively low flow, and so was not as severe as it might have been at high flow.

Another Putah South Canal situation that concerns the Solano Irrigation District is the flooding potential south of Vacaville, where Alamo Creek intersects the canal. During periods of high flow, Alamo Creek often overflows into the canal. On at least one occasion, very high water in Alamo Creek damaged the canal and deposited a large amount of sediment in it. This situation clearly has implications for new development in the southeast Vacaville area.

Another potential seismic hazard occurs where the canal crosses soils that have a locally high liquefaction potential. The three areas where this might be a problem are where the canal crosses Ledgewood Creek on Suisun Valley Road, the Laurel Creek crossing north of Fairfield, and between Ulatis and Alamo Creeks, east of Vacaville. Although it is not certain that liquefiable soils exist at these sites, high water table conditions favoring liquefaction are present in Suisun Valley and east of Vacaville.

Channelized Sections of Alamo Creek

Alamo Creek, where it has been channelized east of Nut Tree Road, is a potential source of flood problems during periods of heavy runoff. Increased urbanization in tributary areas of Alamo Creek and resulting increases in volumes and rates of surface stormwater runoff may result in damaging overflows in areas west of Nut Tree Road which are currently designated for residential densities of from five to seven units per acre.

✓ Levee Conditions

The old levee system which exists in the marshlands of the planning area was constructed initially by hand labor and later by dredging to hold back river floods and daily tides, and hence, to obtain additional lands for grazing and crop growing. Today, these levees remain as embankments five to six feet high with foundation widths of roughly 20 to 30 feet. Roads have been constructed atop a number of levees. Levees are constructed with weak materials excavated from adjacent water courses, i.e., sands, silts, and peat.

Constant maintenance is necessary to hold these levees against the high tides and river floods that threaten reclaimed marsh lands. New material must be added to these levees continually to compensate for peat oxidation. Sand, silt, and peat are weak in shear and erode easily. And each year, as farm lands adjacent to the levees subside (see GROUND FAILURE), hydrostatic pressure against the levees increases, adding to the potential for failure. The fact that most of these levees are not maintained to any specific standards increases the likelihood of failure and inundation.

The potential failure of levees due to liquefaction constitutes a potential hazard in much of the southern half of Solano County. Some enclosed areas are several feet below sea level at present and are subsiding at a rate of up to three inches per year. Most of these diked areas are in agricultural use and some are so far below sea level that it would be economically infeasible to drain them should they be flooded as a result of levee failure. Failure of levees south of Suisun City could flood parts of that city, causing damage to housing.

Roads in the Suisun Marsh and in the east county are constructed almost exclusively on levees; levee failures could seriously disrupt travel through these areas. Although these roads primarily serve local farmers, there is increasing recreational traffic which would also be affected.

FIRE HAZARD

Significant portions of the foothill and mountainous watershed areas of west Solano County are threatened with wildfire (see Figure 3) due to a combination of factors including dense buildups of fire-prone vegetation, the wind-funneling effect of steep topography, poor road access for fire fighting equipment, lack of water service and adequate water pressure at fire-prone elevations, and seasonal atmospheric conditions (warm, dry, falls and summers, and afternoon winds). In addition to these areas of wildfire risk, the Montezuma Hills, Benecia Hills, Potrero Hills, Cement Hills, and eastern English Hills are indicated on Figure 3 as an area of high grass fire risk. These areas consist predominantly of rolling grassland, extensive agriculture grazing lands and other dry farming operations. Fire risk is significant here, although grassland fires are not as potentially intensive as mountainous brush fires, and these hills are relatively accessible by fire-fighting equipment. Furthermore, the likelihood of serious conflagration in the Montezuma Hills has been reduced by fire-preventative measures taken regularly by a number of farmers which include controlled burning, discing and plowing. Such practices are particularly common along roadways where ignition potentials are high.

The likelihood of wildfire ignition in foothill and mountainous areas is increasing with pressures for further development of foothill subdivisions north and west of Vacaville, west of Fairfield, in northern Green Valley, at Cordelia, and on the opposite side of the Vaca Mountains in Napa County. Furthermore, many of these wildfire hazard factors, including poor road access, inadequate water supply and pressure, and ignition potential, are exacerbated by the likelihood of future earthquakes.

Before nearby lowlands were urbanized, the dominant plant species in these west foot-hill and mountainous communities were naturally maintained by periodic fire. But as nearby lands were developed, natural wildfires were suppressed resulting in the further buildup of highly fire-prone brush and woodland assemblages.

Figure 3 conveys two aspects of wildfire hazard: the ignition potential of high-use areas (roads, urbanization) and the burning potential of various vegetative types. For example, grassland adjacent to a heavily traveled road has a high ignition potential because of the high probability and ease with which grass will ignite. A dense woodland canopy, on the other hand, has a low ignition potential with its heavier fuels, but burns with a much higher intensity and ultimately has a worse effect on the ecosystem. The mountainous chaparral assemblages (especially chamise) of west Solano County are notorious for their explosive character and rapid rate of spread. The worst fire hazard occurs where easily ignitable grass is growing with brush which in turn serves as an extremely effective fuel link to the dense woodland canopy.

Areas of extreme wildfire risk as designated on Figure 3 are those mountainous and hilly areas of high ignition potential near fuels with extremely high burning potential, i.e., chaparral (chamise, manzanita, scrub oak, and sage) and dense woodland (live oak, laurel, and madrone). Areas of high wildfire risk on Figure 3 are those with high ignition potential near fuels with high burning potential, i.e., woodland-grass (tree clusters with intervening ground areas occupied by herbaceous growth) and grasslands (principally herbaceous growth).

Water Supply.

Unincorporated Areas of Solano County. Due to the unimproved, rural character of most unincorporated lands in Solano County, fire districts serving these areas are equipped with mobile water supplies, i.e., tank trucks. In addition, land uses in these areas from agricultural intensive (A-5) on up are required to maintain 4000 gallons of water storage or enough water to provide flows of 200 gallons per minute for 20 minutes.

Fairfield. The City of Fairfield recently completed a major water supply expansion program which includes a new 15 MGD water treatment plant and a 10 MG reservoir. These facilities, in addition to the city's previous capacities of 16 MGD treatment and 13.8 MG storage, are adequate to easily provide for significant increases in the maximum daily consumption rate (13 MGD for 1974) plus fire-fighting needs.

Suisun. City of Suisun fire officials consider the water supply in Suisun City to be adequate to support their fire-fighting needs. Beyond its normal water supply (deep wells and the Solano County Irrigation District), the city is developed along the Suisun Slough. Each Suisun City fire truck is equipped with a 2000-foot hose to tap slough waters as necessary for fire-fighting purposes.

Vacaville. Daily flows reached an unprecedented 10 MGD peak during a summer, 1975 hot spell, exceeding maximum daily pumping capacities ($9\frac{1}{2}$ MGD) and posing serious fire protection problems. Since that period, however, two new wells have been added to Vacaville's existing supply and will be "on line" by the summer of 1976, bringing peak capacity up to $12\frac{1}{2}$ MGD, an adequate increase for short-term fire protection purposes. Furthermore, the city is budgeting towards implementation of a newly adopted master plan which will include the construction of one additional reservoir and the rebuilding of two wells to accommodate future growth projections and fire protection needs.

MISCELLANEOUS HAZARDS

Agricultural Spraying

A number of herbicides and insecticides which are classified by the State Department of Food and Agriculture (DFA) as potentially injurious to humans are used in Solano County for weed control in the Montezuma Hills and elsewhere, and for pest control in the extensive vineyard, orchard, and row crop lands of the county. Although hazards from injurious pesticides are experienced predominately in occupational situations (handling), some hazards to neighboring land use may occur in application stages.

If crop spraying activities occurred on croplands adjacent to a non-agricultural, human-occupied use, on a windy day, for example, drift could constitute a hazard to the neighboring use. For this reason, state law stipulates that such sprays shall not be applied within one mile of a residential area. This provision is enforced by the local agricultural commissioner through a permit issuance procedure. Use of any of a list of hundreds of insecticides and herbicides which are classified as "injurious" by the DFA, is prohibited without issuance of such a permit.

Hazardous Cargoes

Although considerations for land use hazards associated with the transport of hazardous cargoes are not specifically required by state planning legislation (see Government Code Section 05302.1), such hazards do exist in Solano County due to the fact that a number of major, interstate transportation routes pass through the area and a wide range of hazardous cargoes are regularly transported along these routes.

Types of hazardous cargoes regularly transported out of, into, and through Solano County by freeway or railroad include flammable liquids, corrosive materials, compressed and/or poisonous gases, explosives, flammable solids, irritating materials,

radioactive materials, etc. The transportation of such cargo in the county creates obvious hazards for existing and proposed land uses adjacent to those transportation routes.

Some potential exists, for example, for spillage of a flammable liquid due to a highway or railway mishap, subsequent ignition of the liberated contents due to its inherently low "flash point," and possible human casualty and property damage occurring in the path of the burning liquid. Burning spillage can also drain into nearby streams and drainage facilities (roadside storm drains, etc.) spreading fire and increasing the area of drainage. Such mishaps have, in fact, occurred in Solano County's recent past.

AREAS OF SPECIAL CONCERN

The county and cities should set priorities for the implementation of the policies enumerated in this general plan element on the basis of where current development pressures and any evident conflicts between land use practices and existing conditions are occurring, and of the relative severity of hazard associated with such conflicts.

Figures 11 and 12 map locations where current land use policies and practices seem to conflict with the development suitability of various planning area lands. These "areas of special concern" have been identified by overlaying Figures 1, 2 and 3 with maps of current land use policy and major utility alignments. Figures 11 and 12 are keyed to the two lists which follow. For the purpose of establishing planning priorities, identified areas of special concern are grouped below in three hazard classifications - very high, high, and moderate:

AREAS OF SPECIAL CONCERN

Hazards Associated with Current Land Use Policy

Note: Numbers below correspond to designations in red on Figure 11.

Very High

1. Estate, medium and high density residential, three school sites, and industrial designations, all atop bay mud
2. Low density residential designation within area of high slope instability (Type A lands) and overlapping area of extreme wildfire risk

Note

A large blackline print of the figure associated with the following legend has been submitted separately with this preliminary draft. Subsequent to staff review and approval, the figure will be reduced to 11" by 17" and included here with the final draft of this element.

FIGURE 11 HAZARDS ASSOCIATED WITH CURRENT LAND USE POLICY

AREA OF SPECIAL CONCERN-
Evident conflict between hazards and
current land use designations
(Numbers keyed to descriptions in
text)

CURRENT LAND USE POLICY

RESIDENTIAL

D.U.'S/ACRE

 Estate Density

.2 - 1



Low Density

2 - 9



Medium Density

10 - 19



High Density

20 +

SCHOOL SITE



COMMERCIAL



INDUSTRIAL



RECREATIONAL



AGRICULTURAL-INTENSIVE
Prime Lands-Specialty Crops



AGRICULTURAL-EXTENSIVE
Grazing and Watershed Lands

3. Mixtures of residential, commercial, and industrial designations within "special studies zone" of Green Valley fault (active), and overlapping areas of extreme and high wildfire risk

High

4. Low density residential designation within area of highly unstable slopes (Type A lands) and overlapping a high wildfire risk area
5. Low density residential designation within area of highly unstable slopes (Type A lands)
6. Same as 5
7. California Medical Facility atop Kirby Hills fault trace (activity unknown)
8. Low density residential designation within area of unstable slopes (Type B lands)
9. Estate density residential designations atop bay mud
10. Estate density residential designation atop fault of unknown activity
11. Industrial designation atop bay mud

Moderate

12. Low density residential designation atop northern fork of Midland fault trace (activity unknown)
13. Industrial designation atop northern fork of Midland fault trace
14. Industrial designations atop southern fork of Midland fault trace
15. Low density residential designation atop fault trace of unknown activity
16. Low density residential atop Kirby Hills fault trace (activity unknown)
17. Low density residential designation atop Kirby Hills Fault trace
18. Commercial designation atop fault trace of unknown activity
19. Industrial designation atop Kirby Hills fault trace
20. Same as 12
21. Estate density residential designation atop fault of unknown activity

AREAS OF SPECIAL CONCERN

Hazards Associated with Major Utility Alignments

Note: Numbers below correspond to designations in red on Figure 12.

Very High

1. Intersection of water main and Green Valley fault trace (active)
2. Convergence of Interstate 80, natural gas pipelines, electric transmission lines, existing and proposed water mains, Putah South Canal, and the Southern Pacific Railroad, passing through "special studies zone" (Alquist-Priolo Geologic Hazards Zone Act) of Green Valley fault trace (active)
3. Southern Pacific Transportation Co. right-of-way (railroad tracks and petroleum pipeline) atop bay mud and crossing "special studies zone" of Green Valley fault trace (active)
4. Intersection of Southern Pacific Transportation Co. right-of-way and "special studies zone" of Concord fault trace (active)

High

5. Potentially liquefiable prime agricultural soils underlie major transportation and transmission alignments.
6. Same as 10
7. Same as 10
8. Intersection of Interstate 80 and Lagoon Valley fault (activity unknown)
9. Northernmost extension of slumping and landslide problems experienced along Putah South Canal (#26 = southernmost extension)
10. Interstate 80 passing through area of highly unstable slopes
11. Intersection of water main and Gordon Valley fault trace (activity unknown)
12. Intersection of Putah South Canal and Kirby Hills fault trace (activity unknown)
13. Intersection of railroad tracks, petroleum line, electric transmission line, and proposed water main alignment with Kirby Hills fault
14. Intersection of Putah South Canal and fault of unknown activity

Note

A large blackline print of the figure associated with the following legend has been submitted separately with this preliminary draft. Subsequent to staff review and approval, the figure will be reduced to 11" by 17" and included here with the final draft of this element.

FIGURE 12 HAZARDS ASSOCIATED WITH MAJOR UTILITY ALIGNMENTS

AREA OF SPECIAL CONCERN-
Evident conflict between hazards and
major utility alignments (Numbers
keyed to descriptions in text)

ALIGNMENTS

- EXISTING GAS MAINS
- EXISTING ELECTRIC
TRANSMISSION LINES
- PROPOSED ELECTRIC
TRANSMISSION LINES
- ~~~~ PETROLEUM PIPE LINES
- EXISTING WATER MAINS
- PROPOSED WATER MAINS
- PUTAH SOUTH CANAL
- MAJOR HIGHWAYS
- SOUTHERN PACIFIC RAILROAD

15. Putah South Canal passes through area of highly unstable slopes
 16. Intersection of Putah South Canal and Lagoon Valley fault
 17. Same as 19
 18. Southernmost extension of slumping and landslide problems experienced along Putah South Canal (#17 = northernmost extension)
 19. Putah South Canal passing through highly unstable slopes and across fault trace of unknown activity
 20. Intersection of Interstate 80 and fault trace of unknown activity
 21. Natural gas pipeline passing through area of highly unstable slopes
 22. Southern Pacific Railroad tracks and electrical transmission lines atop extensive bay mud
 23. Electrical transmission line atop bay mud
 24. Southern Pacific Railroad and electrical transmission lines atop bay mud
 25. Southern Pacific Transportation Co. right-of-way (railroad tracks and petroleum pipeline) atop bay mud
 26. Interstate 80 passing through areas of high slope instability
 27. Intersection of natural gas pipeline and fault trace of unknown activity
 28. Intersection of Interstate 80 and fault of unknown activity
 29. Intersection of Interstate 80 and natural gas pipeline with fault traces of unknown activity
 30. Intersection of petroleum and natural gas pipelines with Kirby Hills fault trace
 31. Petroleum line and natural gas pipeline atop bay mud
- Moderate
32. Intersection of natural gas line and northern fork of Midland fault trace (activity unknown)
 33. Intersection of Temporary Interstate 505 and southern fork of Midland fault trace (activity unknown)

34. Intersection of Interstate 80 and northern fork of Midland fault trace
35. Intersection of Southern Pacific Transportation Co. right-of-way (railroad tracks and petroleum line) and northern fork of Midland fault trace
36. Intersection of Interstate 80 and southern fork of Midland fault trace
37. Intersection of State Route 113 and northern fork of Midland fault trace
38. Intersection of Southern Pacific Transportation Co. right-of-way (railroad tracks and petroleum line) and southern fork of Midland fault trace
39. Intersection of State Route 113 and southern fork of Midland fault trace
40. Intersection of natural gas pipeline and northern fork of Midland fault trace
41. Intersection of natural gas pipeline and southern fork of Midland fault trace
42. Intersection of petroleum line and northern fork of Midland fault trace
43. Intersection of petroleum line and southern fork of Midland fault zone
44. Intersection of natural gas pipeline and Midland fault trace
45. Boundary of bay mud deposits

NOISE

DEFINITION AND MEASURE

Noise can be defined as unwanted or undesirable sound. However, what constitutes undesirable sound is difficult to define and often involves subjective evaluation. Noise and its effect on the listener is described in three dimensions: (1) frequency, (2) intensity, and (3) time (fluctuation).

The human ear is sensitive to a wide range of sound intensities. A logarithmic scale, called the decibel (dB), is used to represent this wide range. A given sound level in decibels describes the intensity or pressure level of sound waves traveling outward from a source. The threshold of human hearing corresponds roughly to zero dB.

Sound is usually measured in terms of its level in decibels above or below ambient level or an arbitrary reference quantity (often the faintest sound audible to the average healthy young person). When measuring urban noise, two of the three acoustic dimensions,

frequency and intensity are measured using a sound level meter with a special sound filter. This filter, called an A-weighting filter, measures only that noise which falls within a frequency range of 20-20,000 Hz (Hertz, or cycles per second of noise vibration). In monitoring a noise source, the A-weighted filter weighs all of the frequencies which are generated, and averages them to produce a single number, the A-weighted level. Table 9 shows the sound level of typical noise sources encountered in an urban environment.

A-weighting is incorporated in all sound level meters. The A-weighted scale accurately describes noise at a particular instant in time; however, urban noise is generated by both distant and near sources and varies continuously. Distant sources may include traffic, wind through trees, and industrial activity. These sources are fairly constant for short periods of time, but vary from hour to hour and day to day. Nearby sources such as a passing automobile or an aircraft overflight cause the urban noise level to fluctuate from moment to moment.

Changing noise is generally more disagreeable than steady noise. Currently, time variation in A-weighted noise is accounted for differently by various concerned government agencies (U. S. Department of Transportation, State of California Environmental Agency, Federal Aviation Administration, etc.).

The U. S. Department of Transportation accounts for the time-varying character of environmental noise statistically. The statistical descriptors are the A-levels or noise levels exceeded either 90, 50, or 10 percent of the time over a 24 hour day, designated L_{90} , L_{50} , or $L_{10} = \text{dB(A)}$. L_{90} represents a good estimate of the background noise caused by distant sources. L_{50} is the average level and L_{10} is the "average peak" level caused by nearby sources of short duration. Each of these single number descriptors accounts for the three dimensions of urban noise: frequency, intensity, and time-varying characteristics.

The State of California Environmental Quality Agency accounts for the time variation of A-weighted noise by averaging all levels reached, and refers to these averages as Community Noise Equivalent Levels (CNELs). CNEL noise contours represent the average of all noise levels reached during a 24 hour day, adjusted to an equivalent level. This adjustment accounts for the lower tolerance of people to noise during evening and nighttime periods relative to the daytime periods.

TABLE 9. TYPICAL URBAN NOISE SOURCES AND LEVELS

Source	Decibels, A-weighted (dBA)
Civil defense siren @ 100 ft.	140
Jet takeoff @ 200 ft.	130
Riveting machine, rock music band	110
DC-10 flyover @ 700 ft., pile driver @ 50 ft.	100
Subway train @ 20 ft.	90
Garbage disposal in home @ 3 ft., inside sports car @ 50 mph	80
Freight train @ 100 ft., vacuum cleaner @ 10 ft., speech @ 1 ft.	70
Auto traffic near freeway, large store, accounting office	60
Large transformer, private business office, light traffic @ 100 ft.	50
Minimum levels - residential areas in San Francisco at night	40
Soft whisper @ 5 ft.	30
Rustling leaves, recording studio	20
Threshold of hearing in youth (1000 - 4000 Hz)	0

NOISE STANDARDS

The effects of noise on people can be grouped in three general categories:

1. Subjective effects of annoyance, nuisance, dissatisfaction;
2. Interference with activities such as speech, sleep, learning;
3. Physiological effects such as startle, hearing loss.

The sound levels associated with urban noise generally produce effects only in the first two categories. Yet, at any given level, individual responses will vary considerably. Annoyance, nuisance, dissatisfaction, and startle effects can happen at virtually any level. The response of an individual depends on such factors as time duration, frequency content, background noise level, and the hearer's activity at the time. A considerable amount of evidence has been compiled by the U.S. Environmental Protection Agency which correlates certain constant noise levels with speech interference, sleep disturbance, and hearing loss. The standards recommended in Tables 1 and 2 are based in part on this research.

The level identified for the protection of speech communication is 45 dB (CNEL) within the home. Allowing for a 15 dB reduction in ground level between outdoors and indoors, this level becomes an outdoor day-night sound level of 60 dB (CNEL) for residential areas. For outdoor voice communication, a day-night background noise level of 60 dB (CNEL) allows normal conversation at distances up to around six feet, but interferes with speech at a speaker-to-listener distance of about 12 feet. Long-term exposure to levels exceeding 70 dBA causes hearing loss.

Although speech interference has been identified as the primary noise conflict with human activity and as the principal reason for adverse community reactions to noise and long-term annoyance, a margin of safety of 5dB should be applied to the maximum outdoor level to give adequate weight to other adverse effects. Therefore, a L_{dn} level of 55 dB is identified by the Environmental Protection Agency as the maximum outdoor level in residential areas compatible with the protection of the public health and welfare. With respect to complaints and long-term annoyance, this level is clearly a maximum, satisfying a large majority of the population. However, specific local situations, attitudes, and conditions may make lower levels desirable for some locations.

The following general noise perception evaluations are accepted by noise experts:

1. Except in carefully controlled laboratory experiments, an increase of only one dB in A-Level cannot be perceived.

2. Outside of the laboratory, a three dBA increase is considered to be a barely noticeable difference.
3. A change of at least five dBA is required before any noticeable change in community response can be expected.
4. A ten dBA increase is subjectively heard as a doubling in loudness, and would almost certainly cause adverse response in the community.

PRESENT NOISE CONTOURS

Community Noise Equivalent Level (CNEL) contours have been plotted for the present and future (1995) in Figures 4 through 9. The principal source of noise in the planning area is vehicular traffic, followed by local airport and railroad operations.

Vehicular Traffic. U.S. Interstate Highway Routes 80, 505, 605, and 780, and California Routes 12, 29, 37, 84, 113, 141, and 220 are all major contributors to existing acoustical conditions in Solano County. Peak noise levels on these highways are accountable to truck traffic. Where these routes pass through Fairfield, Suisun, and Vacaville as local arterials, stop and go traffic contributes to peak noise levels. During evening hours, noise from vehicular traffic in the planning area remains at audible background levels.

Highway CNEL contours were plotted for highways based upon data on traffic counts and characteristics obtained from the California Department of Transportation, Stockton Division. Contours on local arterials were translated from traffic counts and roadway dimensions provided by the Cities of Fairfield and Vacaville.

Airport Operations. Aviation activities at Travis Air Force Base and Nut Tree Airport are the principal sources of aircraft noise in Solano County. Present noise contours indicated for Travis Air Force Base were adopted from mapped data made available by the U.S. Air Force, dated January, 1964. These contours represent the worse noise conditions that can be expected, according to Air Force personnel, since aircraft activity at the time of measurement was considerably greater than present levels. In 1964, Travis AFB was providing major support for military actions in Southeast Asia. Base personnel estimate that air traffic in 1964 exceeded present levels by roughly 500 percent. Furthermore, the types of aircraft operating out of Travis at that time included Strategic Air Command (SAC) B-52's, a significantly noisier aircraft than those flying in and out of Travis today, including the C5A Galaxy. SAC activities have since been discontinued at Travis AFB.

Adaptions were made to Air Force contour maps by the consultants to show contours as CNEL's and to extend contours to CNEL 45.

Present CNEL contours as indicated for the Nut Tree Airport were mapped from the recently completed Nut Tree Airport Environmental Impact Assessment Report by August W. Compton and Associates, 1974.

Railroad Operations. Train passages are a major contributor to peak noise levels through the central portion of Solano County, especially in areas where railway lines run parallel to highways. Train passages on Southern Pacific's A, AA and AD lines (see Figures 4 and 7) are heard intermittently throughout the day and night. Passages on the Southern Pacific's AAB line and on the Sacramento Northern Lines in the county are much more intermittent and do not appreciably effect the noise environment. CNEL contours due to railway traffic were calculated by the consultants from information obtained from the Southern Pacific Transportation Company, and methods outlined in Assessment of Noise Environments Around Railroad Operations (Swing, July, 1973).

PLANNING AREA CASE STUDIES

A series of case studies were prepared by the consultant as a part of the evaluation of existing conditions for Solano County and the cities of Fairfield, Vacaville, and Suisun City. During the morning and afternoon of August 11, 1975, noise measurements were made at six locations in the cities of Fairfield and Vacaville. The data was measured using the methodology described in the accompanying Appendix C.

Site #1: Located in the backyard of a home at 488 Manzanita Street, about 150 feet south of I-80.

Time: 8:35 A.M.

Background Sources: Distant traffic.

Peak Sources: Traffic on I-80.

Measurements: $L_{10}=75$; $L_{50}=68$; $L_{90}=62$.

The CNEL at this location is estimated to be about 75, significantly exceeding the recommended maximum level standard of CNEL 65 for residential environmental noise.

Site #2: Located at a vacant lot about 1-1/2 miles north of Airbase Parkway on the south side of I-80.

At Site #2, an evaluation was made of the noise reduction provided by the masonry wall built along I-80 to shield an FHA-financed housing development located several hundred feet from the freeway. The data recorded at Site #2 reflects the approximate noise level in the backyards of the FHA homes.

Time: 9:04 - 9:14 A.M.

Background Sources: Distant traffic, cars on I-80.

Peak Sources: Trucks on I-80.

Measurements: $L_{10} = 69$; $L_{50} = 65$; $L_{90} = 62$.

Based on this data, CNEL is estimated to be about 69. Although the wall is 13 feet high, it still does not shield the homes from one of the loudest highway noise sources, the exhaust of the diesel trucks. An effective noise barrier must completely break the line-of-sight between the source of noise and the receiver. This wall blocks the line-of-sight to two significant highway noise sources, tire-roadway interaction of cars and trucks and the engine noise of the trucks, but does not block sight of truck exhausts. Since truck exhausts account for much of the noise level generated on I-80, the wall is not an adequate noise barrier. To test the maximum noise reduction that could be provided by the wall, highway noise was monitored from a creek bed 50 feet from the wall (Site #3), thereby completely breaking the line-of-sight between the listener and the truck exhausts.

Site #3: Creek bed about 50 feet from FHA-required wall.

Time: 9:20 - 9:30 A.M.

Background Sources: Distant traffic.

Peak Sources: Traffic on I-80.

Measurements: $L_{10} = 65$; $L_{50} = 60$; $L_{90} = 56$.

Surprisingly, the L_{10} at the creekbed had not been reduced by more than four decibels. However, the less than expected reduction may be the result of sound leakage through the cracks in the wall and around the ends of the wall. As presently designed, the wall probably reduces traffic noise by somewhere between 5 and 10 dB. If it were increased in height and length, the wall could achieve a maximum noise reduction of about 15 dB.

Site #4: Located in front of 1302 Pennsylvania Avenue near Grant in Fairfield, about 15 feet from the center of the near lane.

Time: 11:15 - 11:25 A.M.

Background Sources: Dogs barking, leaves rustling and distant traffic.

Peak Sources: Automobiles on Pennsylvania Avenue.

Measurements: $L_{10} = 72$; $L_{50} = 61$; $L_{90} = 55$.

At this location, the 24-hour CNEL is probably around 70, and in the front yards of the homes along this street, the level probably ranges between 68 and 70 CNEL.

Site #5: Located on Alamo Drive in Vacaville near Danfield, about 27 feet from the center of the near lane, at property line of new apartment building called Alamo South Unit 6.

Time: 11:55 A.M. - 12:05 P.M.

Background Sources: Distant traffic, children playing.

Peak Sources: Through traffic on Alamo and stop-and-go traffic on Danfield.

Measurements: $L_{10} = 70$; $L_{50} = 62$; $L_{90} = 52$.

At this location, CNEL was approximately 68 dB.

Site #6: Located in parking lot adjacent to 2-story apartment building at 519 East Monte Vista near Hillside.

Time: 12:35 - 12:45 P.M.

Background Sources: Distant traffic.

Peak Sources: Through traffic on East Monte Vista and people talking nearby.

Measurements: $L_{10} = 73$; $L_{50} = 67$; $L_{90} = 58$.

At this location, the CNEL is approximately 71 dB.

In addition to the aforementioned measurements, Peabody Road was field-checked south of the intersection with Elmira and south of its intersection with California Drive. Traffic noise on Elmira east of Peabody was also field-checked. The project noise consultants felt that the evident noise exposure for housing in these areas also exceeded acceptable levels.

FUTURE NOISE CONTOURS

Vehicular Traffic. Noise due to vehicular traffic will rise substantially in many areas of Solano County by the design year 1995. By 1995, CALTRANS District 10 expects a reduction in speed on many sections of U.S. Interstate 80 of approximately 20 m.p.h. These estimated speed reductions are based upon a traffic forecast for the route of nearly twice present volumes. Similar increases are expected on many other highways in Solano County. No current projections were available concerning future average daily traffic counts on major arterials in Fairfield, Suisun City, and Vacaville. Therefore, future noise contours were predicated on the basis of each arterial's maximum traffic capacity and probable level of usage by trucks. As vehicle noise mitigation technology improves, and with the continued enforcement of the California Motor Vehicle Noise Standards, traffic noise levels could decrease by as much as 5 dB from those presently predicted for the future, as mapped on Figures 8 and 9.

Aircraft operations. Peak day operations from Nut Tree Airport are projected to rise from an estimate of 666 operations in 1974 to a forecast of 1100 operations in 1994. Future CNEL contours as mapped for Nut Tree Airport are from the Nut Tree Airport Environmental Impact Assessment Report by August W. Compton and Associates, 1974.

Future and present CNEL contours for Travis Air Force Base are not available at this time. Later this year, a set of contours will be available. Assuming no major change in mission, the CNEL contours should be approximately equal to present contours and should be somewhat less than those mapped from 1964 data. When Travis' future contours become available, they should be reviewed to determine any changes from current forecasts and Figure 7 should be revised accordingly.

Railroad Operations. Southern Pacific Transportation Company predicts no sizeable increase in rail operations in Solano County in the future on its main lines. However, with the present energy crisis, Amtrak and freight activities could change appreciably at any time. When the Busch plant which will be served by S.P.'s AA Line commences operation, there will be a considerable amount of switching on a 24-hour basis. Exact figures, however, are not available at this time. And finally, proposals for commuter runs along S.P. tracks between San Francisco and Sacramento are becoming increasingly feasible with the incipient fuel situation. Such commute provisions would increase traffic frequency through Solano County, perhaps significantly.

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APPENDIX

APPENDIX A

THE MERCALLI INTENSITY SCALE

(As modified by Charles F. Richter in 1956 and rearranged)

*If most of these effects
are observed**then the
intensity is:**If most of these effects
are observed**then the
intensity is:*

Earthquake shaking not felt. But people may observe marginal effects of large distance earthquakes without identifying these effects as earthquake-caused. Among them: trees, structures, liquids, bodies of water sway slowly, or doors swing slowly.

I

Effect on people: Shaking felt by those at rest, especially if they are indoors, and by those on upper floors.

II

Effect on people: Felt by most people indoors. Some can estimate duration of shaking. But many may not recognize shaking of building as caused by an earthquake; the shaking is like that caused by the passing of light trucks.

III

Other effects: Hanging objects swing.
Structural effects: Windows or doors rattle. Wooden walls and frames creak.

IV

Effect on people: Felt by everyone indoors. Many estimate duration of shaking. But they still may not recognize it as caused by an earthquake. The shaking is like that caused by the passing of heavy trucks, though sometimes, instead, people may feel the sensation of a jolt, as if a heavy ball had struck the walls.

V

Other effects: Hanging objects swing. Standing autos rock. Crockery clashes, dishes rattle or glasses clink.

Structural effects: Doors close, open or swing. Windows rattle.

Effect on people: Felt by everyone indoors and by most people outdoors. Many now estimate not only the duration of shaking but also its direction and have no doubt as to its cause. Sleepers awakened.

Other effects: Hanging objects swing. Shutters or pictures move. Pendulum clocks stop, start or change rate. Standing autos rock. Crockery clashes, dishes rattle or glasses clink. Liquids disturbed, some spilled. Small unstable objects displaced or upset.

Structural effects: Weak plaster and Masonry D* crack. Windows break. Doors close, open or swing.

VI

Effect on people: Felt by everyone. Many are frightened and run outdoors. People walk unsteadily.

Other effects: Small church or school bells ring. Pictures thrown off walls, knickknacks and books off shelves. Dishes or glasses broken. Furniture moved or overturned. Trees, bushes shaken visibly, or heard to rustle.

VII

Structural effects: Masonry D* damaged; some cracks in Masonry C*. Weak chimneys break at roof line. Plaster, loose bricks, stones, tiles, cornices, unbraced parapets and architectural ornaments fall. Concrete irrigation ditches damaged.

Effect on people: Difficult to stand. Shaking noticed by auto drivers.

Other effects: Waves on ponds; water turbid with mud. Small slides and caving in along sand or gravel banks. Large bells ring. Furniture broken. Hanging objects quiver.

Structural effects: Masonry D* heavily damaged; Masonry C* damaged, partially collapses in some cases; some damage to Masonry B*; none to Masonry A*. Stucco and some masonry walls fall. Chimneys, factory stacks, monuments, towers, elevated tanks twist or fall. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed piling broken off.

VIII

Effect on people: General fright. People thrown to ground.

Other effects: Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes. Steering of autos affected. Branches broken from trees.

Structural effects: Masonry D* destroyed; Masonry C* heavily damaged, sometimes with complete collapse; Masonry B* is seriously damaged. General damage to foundations. Frame structures, if not bolted, shifted off foundations. Frames racked. Reservoirs seriously damaged. Underground pipes broken.

IX

Effect on people: General Panic.

Other effects: Conspicuous cracks in ground. In areas of soft ground, sand is ejected through holes and piles up into a small crater, and, in muddy areas, water fountains are formed.

Structural effects: Most masonry and frame structures destroyed along with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes and embankments. Railroads bent slightly.

X

Effect on people: General panic.

Other effects: Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud shifted horizontally on beaches and flat land.

Structural effects: General destruction of buildings. Underground pipelines completely out of service. Railroads bent greatly.

XI

Effect on people: General panic.

Other effects: Same as for Intensity X.

Structural effects: Damage nearly total, the ultimate catastrophe.

Other effects: Large rock masses displaced. Lines of sight and level distorted. Objects thrown into air.

XII

• Masonry A: Good workmanship and mortar, reinforced, designed to resist lateral forces.

Masonry B: Good workmanship and mortar, reinforced.

Masonry C: Good workmanship and mortar, unreinforced.

Masonry D: Poor workmanship and mortar and weak materials, like adobe.

APPENDIX B**NOTICE TO BUILDING PERMIT APPLICANTS RE: EXPANSIVE SOIL CONDITIONS**

Expansive soil conditions are found in many parts of the planning area and are the cause of considerable damage to residential construction. These soils tend to swell considerably when wet and shrink and crack when dry. Non-uniform shrink/swell behavior causes foundation cracking and general settlement. Related heave may throw wood frames out of plumb.

Where expansive soils are present, the Building Official recommends and may require that applicants submit evidence of adequate soil and structural engineering measures aimed at preventing or minimizing expansive soil damage. Where this requirement is waived because of the small size of the project or hardship considerations, the following minimum design provisions are recommended to reduce expansive soil damage to conventional residential structures:

1. Pier and grade beam foundations, or conventional footings shall extend to a depth of at least 30 inches.
2. Use of slab-on-grade construction shall be avoided, especially in living areas, since cracking, heaving, or settling of such slabs are common.
3. Water shall not be allowed to collect or pond near foundation or slabs.
4. Swimming pools and decks are especially vulnerable to shrink-swell related problems. Swimming pool contractors shall use a pool design which contains special provisions for expansive soil conditions.

The foregoing precautions will not necessarily prevent all damage due to expansive soils, but will minimize some of the most common problems.

APPENDIX C: NOISE MEASUREMENT PROCEDURE AND FIELD INSTRUMENTATION

A Bruel and Kjaer (B&K) Model 166/S.45 Environmental Noise Classifier was used to monitor the outdoor environment in the Study Area. The Model 166/S.45 is a self-contained instrument which can be used to obtain the statistical distribution of environmental noise. It divides the noise level into eleven amplitude classes and one exceedance class (alternating class widths of 2 dB and 3dB). The baseline of the analysis (the lower limit of the lowest amplitude class) can be set from 60 dBA to 100dBA in nine 5-dBA steps with an additional setting at 45 dBA. The dynamic range of the instrument is 30 dBA. A twelve-volt battery and a Tripp-Lite power inverter were used to power the equipment during the measurements.

A General Radio (GR) Model 1565B Sound Level Meter verified that the B&K 166/S.45 was operating in the correct range. Then the signal from the sound level meter was fed into the B&K 166/S.45 (instead of using the microphone input directly into the B&K 166/S.45) in order to establish a clearer signal by which low noise levels may be more accurately measured.

The instrumentation was calibrated before, during, and after the survey with a GR 1562-A sound level calibrator. The calibrator tone was a sound pressure level of 114 dB re $2 \times 10^{-5} \text{ N/m}^2$ at a frequency of 1000 Hz.

The following is a complete list of our field measurement instrumentation with serial numbers:

Bruel and Kjaer Environmental Noise Classifier
Model 166/S.45 Serial No. 179

Bruel and Kjaer Windscreen
Model UA-0207

General Radio Sound Level Calibrator
Type 1562-A Serial No. 9086

Tripp-Lite Power Verter
Model PV-100

Viking Battery Charger
Model VA 7612

6-Foor Miniture Phone Plug to BNC Cable

Trojan 12-volt Batteries
Type R-24M

Teac Headphones

Bacharach Sling Psychrometer
Model 12-2006

Dwyer Wind Meter

Brueel and Kjaer Tripod

PRELIMINARY DRAFT
GENERAL PLAN REVISION PROGRAM

SCENIC ROADWAYS

Prepared for the

COUNTY OF SOLANO
CITY OF FAIRFIELD
CITY OF VACAVILLE
CITY OF SUISUN

Prepared by
SEDWAY/COOKE
Urban and Environmental
Planners and Designers
San Francisco, California

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INTRODUCTION

PURPOSE

This scenic roadways element has been formulated for the purposes of designating a scenic roadway system for the planning area, and to protect and improve that system while accommodating a reasonable level of growth. Due to the prevailing non-urban character of the county and the general plan policies currently set forth in related elements which promote retention of the majority of the county's non-urban lands in their present status, the primary intent of the scenic roadways element is to recognize and respect the distinctiveness of the various non-urban landscapes occurring throughout the county and to reinforce the intentions of the open space and conservation elements now in effect in the county and cities. Towards this end, the element provides a series of precise guidelines for use in a regulatory process under which new development may be properly integrated into the roadside environment. These guidelines or policies shall serve as standards for the review and approval of buildings, signs, landscaping, road construction, utility installation, etc., within a designated scenic corridor.

This scenic roadways element should be seen as an initial step in the formulation of a county-wide community design element. Such an element should ultimately consist of two parts. The first would be primarily a protective one which recognizes and serves to preserve the value of scenic elements that currently exist. The second part would coordinate these protective policies into a comprehensive community design plan which would set forth design requirements. For example, policies for a county-wide park system, trails system, and scenic roadway network could be closely coordinated and integrated in the community design plan. The design element would serve to interrelate the visual and functional requirements of all general plan elements including land use, open space and conservation, housing, circulation, health and safety, and so on.

APPROACH

In formulating new planning policies with respect to the regulation and maintenance of a scenic route network as extensive as that designated for the planning area, the overriding consideration must be the need for administrative manageability, efficiency, and short range effectiveness. In that light, this element avoids an individual policy response to each designated scenic route. Instead, all routes are treated similarly in

terms of a fixed set of visual components which in different combinations may be common to a number of routes.

Visual Units

Based on field survey, each scenic route has been segmented into a number of visual units as mapped on Figure 1. The beginning and end of each segment or visual unit is signaled by a major change in landscape features as seen from the roadway. All of the visual units comprising each scenic route have been described and coded on Figure 1 in terms of a fixed number of distinct foreground and distant views as sketched on pages 4 through 7, which in different combinations may be common to a number of visual units.

In addition to the distinct foreground and distant components of each visual unit, a number of special features which should be recognized in the scenic route protection and improvement program have been noted along each route. Examples are such features as bridges, creeks, vista points, transmission lines, roadside shade trees, etc.

Policy Application

Policies for scenic route protection and enhancement are divided into two groups. The first consists of general policies that apply to all designated scenic roadways. The second group consists of a number of specific policies which shall be applied on a visual unit and special feature basis. A set of such specific plan policies has been formulated for each classification of foreground and distant view in response to their visual characteristics and vulnerability, and for each special feature. Thus, policies which apply to a particular visual unit are those which are associated with the foreground and distant view components of that unit, as listed on pages 9 through 16, and with any special features which may occur in the unit.

FIGURE 1

DESIGNATED SCENIC ROADWAYS AND VISUAL UNITS

Note: A large blackline print of this figure has been submitted separately with this preliminary draft. Subsequent to staff review and approval, the figure will be reduced to 11" by 17" and included here with the final draft of this element.

FIGURE 2
COMPONENTS OF A ROADWAY VIEW

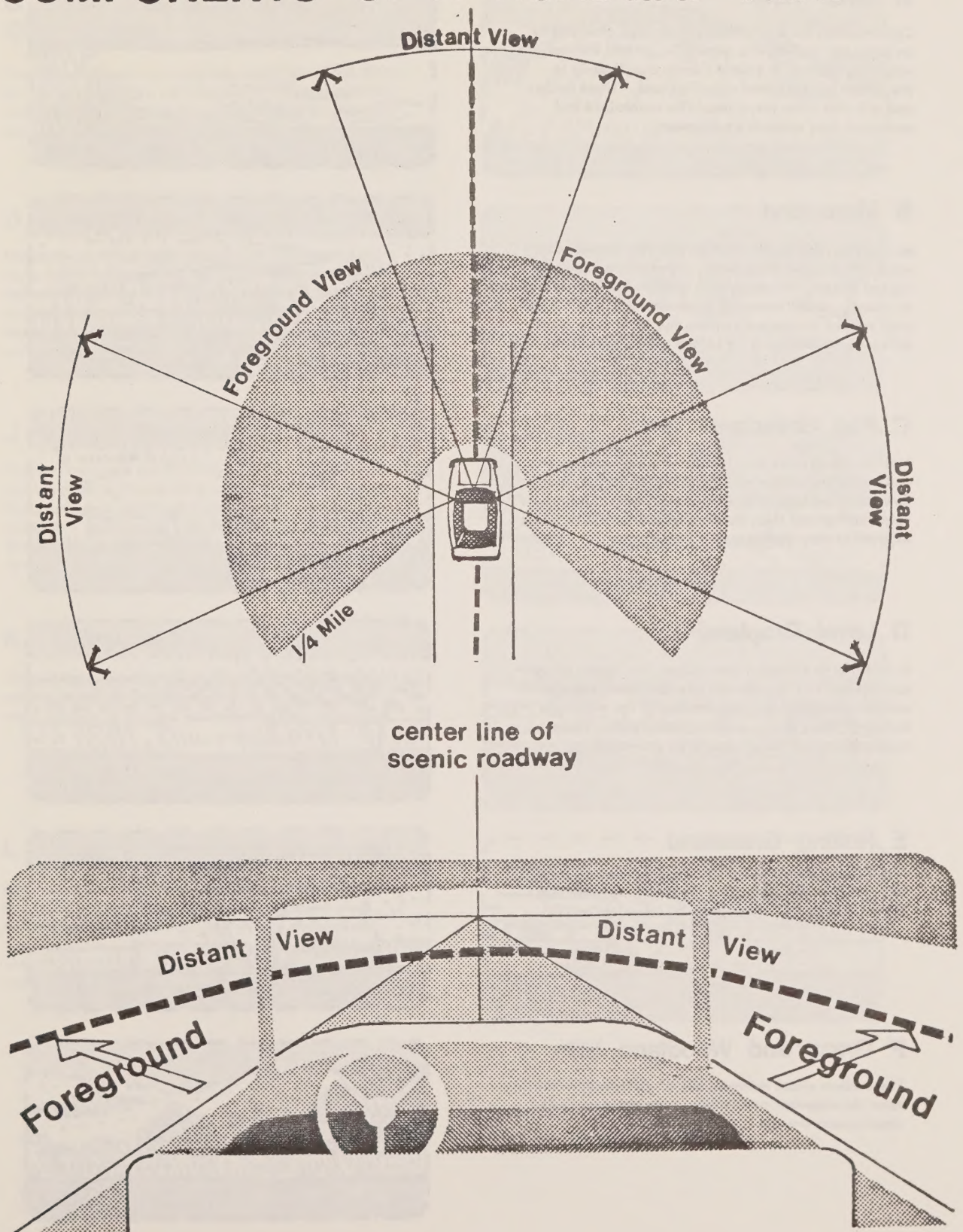
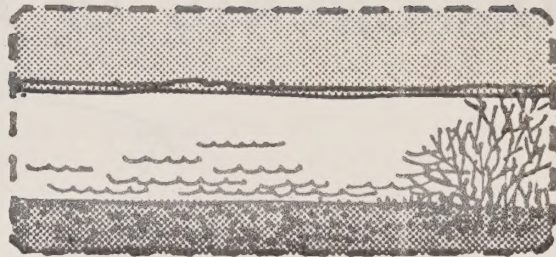


FIGURE 3 FOREGROUND VIEWS

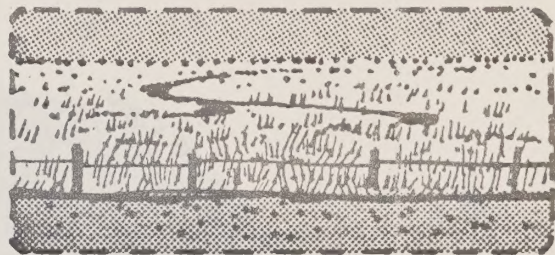
A River View

Opportunities for an expansive river view provided by an adjacent roadway are unusual in general and are relatively limited in Solano County as compared to the extent of other view classifications. These unique and valuable river views should be maintained and protected from roadside development.



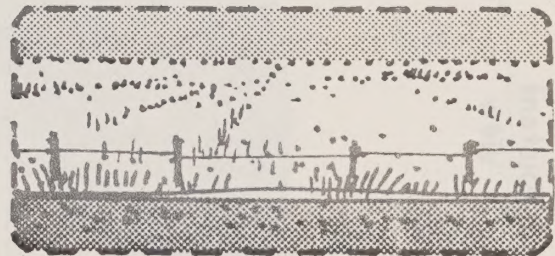
B Marshland

Marshlands provide travelers on adjacent scenic roadways with a sense of openness, views of a unique ecological system, and long range vistas. It is impossible to visually absorb intensive development within a marsh area without seriously disrupting the local ecological balance and destroying its unique visual character.



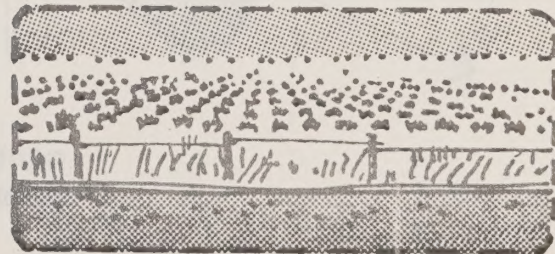
C Flat Grassland

Flat grasslands, due to a lack of varying topography and heavy vegetation which would screen new structures and land alteration from view, have a high visual vulnerability and thus, no development capacity where exposed to view from a scenic roadway.



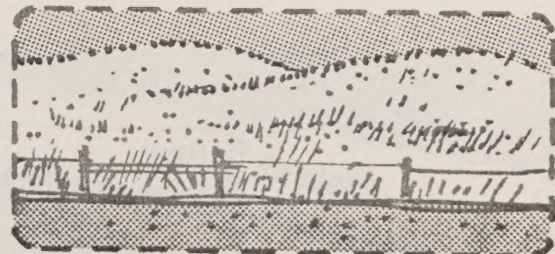
D Level Cropland

In addition to evident visual values, the scenes of agricultural activity apparent in this component are significant in conveying an understanding of the value and history of these fertile planning area lands. These vulnerable visual values should be protected.



E Rolling Grassland

The distinct smoothness of the natural terrain and the lack of sheltering vegetation make rolling grasslands highly vulnerable to disruption by urbanization.



F Grass and Woodland Hills

The medium visual vulnerability of grass-woodland hills make development permissible where stringent design requirements are met.



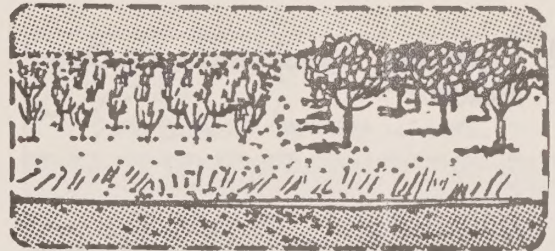
G Steep Hills with Rock Outcroppings

The distinctive rock outcroppings and unique land forms of this visual unit are well-known as natural landmarks and should be protected from encroachment by development.



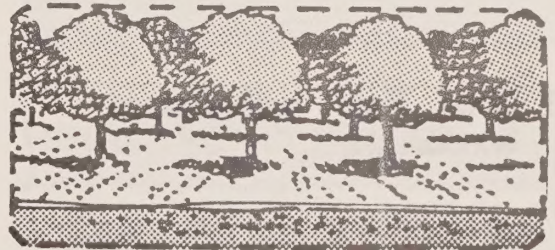
H Vineyards and Young Orchards

The rhythmic effect of grapevine and young tree spacing is highly vulnerable to disruption by discordant development near the roadside. In addition, these views are significant in conveying an understanding of the fertile value and history of these county lands. Such views should be maintained and protected.



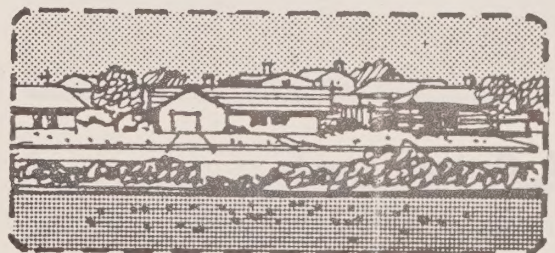
J Mature Orchard

The confining and sheltering effect of a natural tree canopy close to the roadside and the rhythmic effect of the tree spacing is vulnerable to disruption by discordant development near the roadside. The aesthetic and educational experiences offered by this foreground view should be protected.



K Residential

Since the foreground of this visual unit has a low visual vulnerability, background views become the primary concern in terms of maintenance and protection.



L Urban (commercial/industrial)

Like residential units, the foreground of this visual unit has a low visual vulnerability and background views become a primary concern. Vulnerable background views shall be protected from obstruction by man-made elements associated with commercial/industrial development.

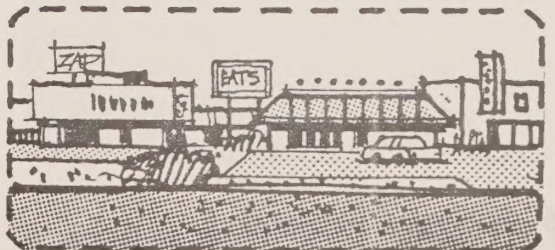
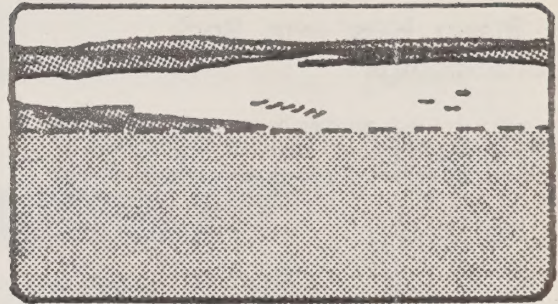
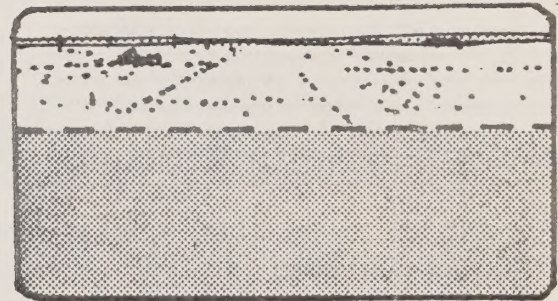


FIGURE 4 DISTANT VIEWS

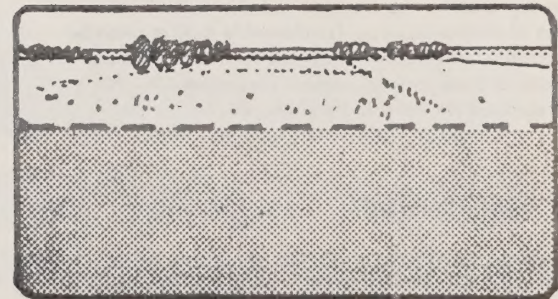
1 Bay



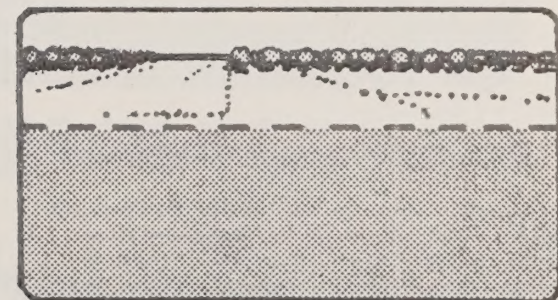
2 Flatlands, Marshlands, or Open Fields



3 Open Fields with Distant Windbreaks



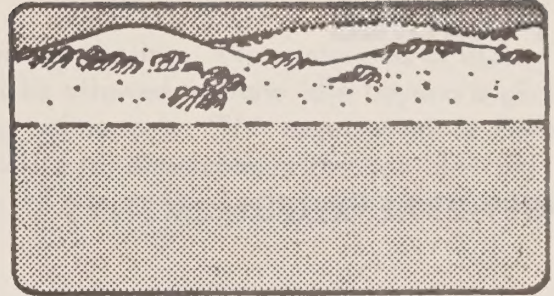
4 Orchard Lands



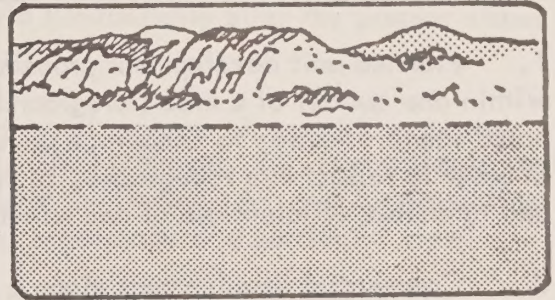
5 Rolling Grassland



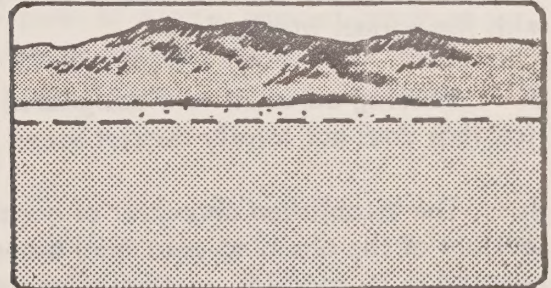
6 Grass and Woodland Hills



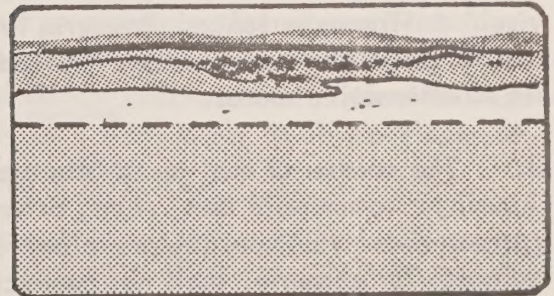
7 Steep Hills with Rock Outcroppings



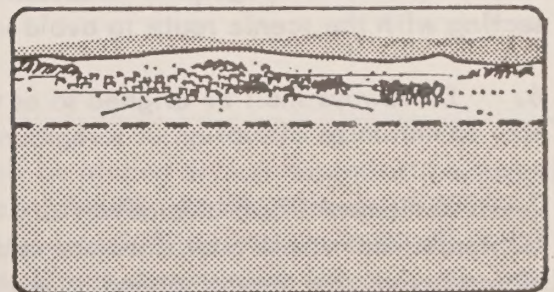
8 Vaca Mountains



9 Long Range Urban Views Over Bay



10 Background Urbanization



POLICIES

GENERAL REQUIREMENTS

The following general policies shall apply to all foreground and distant view components:

1. Planned unit development procedures shall be mandatory for all development within one quarter of a mile (foreground and intermediate background) of a designated scenic roadway to encourage development compaction, and building clustering in order to reflect site topography, to provide opportunities for open space relief, and to enable efficient use of and minimum visual disruption by supporting facilities.
2. Commercial development along a designated scenic roadway shall be visually compact with parking arranged to be visually unobtrusive and to avoid interference with the normal traffic flow.
3. Fencing adjacent to a designated scenic roadway shall be of an open construction that does not totally restrict views through to foreground and distant views.
4. The established character of narrow, curving scenic roadways on the hilly west sections of the planning area shall be preserved. The winding routes, often tightly hemmed in by roadside vegetation and steep topography, are highly appropriate for such situations where the emphasis should not be on speed, but on revealing a rich visual driving experience. Pressures to improve such roads to accommodate greater traffic speeds shall be resisted. Instead, ways should be sought to divert faster traffic to alternative routes.
5. The number of man-made interruptions or incidents along a scenic roadway (housing, commercial uses, signs, driveways, etc.) shall be limited to maintain the current visual values as the prevalent feature of the route. Individual driveways and garages, for example, shall not connect directly with a scenic roadway unless necessitated by severe topographic constraints. Rather, they shall combine before intersecting with the scenic route to avoid visual and functional disruption.
6. Driveways shall be aligned so as to cut off lateral views to garages, dwellings, etc. to minimize disruption of foreground views.
7. Placement of off-site advertising along a designated scenic roadway shall be prohibited, except where provisions are made, as part of a standardized, public, on-road sign program, for providing signing within the roadway right-of-way for roadway-related services.

8. Limitations shall be placed on development phasing. No excavated or cleared site within the primary view corridor shall be allowed to stand idle beyond a given time (time should be stipulated in the grading ordinance). (This requirement is directed specifically to the practice of preparing a site for development through clearing and rough grading and then allowing the scarred site to stand idle until a prospective developer is found).

9. Travel speeds should be established at levels which do not require imposition of roadway improvement standards which would substantially alter the present visual experience of the scenic roadway.

10. The county and cities shall institute a special program of roadside maintenance (landscape maintenance or replacement, litter retrieval, etc. along scenic routes, recognizing the fact that the immediate roadside environment has a great impact on the motorist and tends to color his or her total experience of a particular view.

11. Pullovers with litter cans should be provided at regular intervals throughout the scenic roadway network for convenient disposal of litter. Special points of interest such as outlooks, creeks, lakes, clusters of roadside shade trees, etc., should be favored in locating pullover sites.

SPECIFIC POLICIES

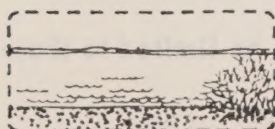
All designated scenic roadways shall be subject to a combination of specific policies based on the composition of each visual unit along the route. The combination of policies associated with the foreground and distant component of each visual unit (and with any special features) as noted on Figure 1 shall apply to all development that falls within view of the designated scenic roadway.

The foreground component of each visual unit shall be subject to the related specific policies listed below:

FOREGROUND COMPONENT

SPECIFIC POLICIES

A. River Views



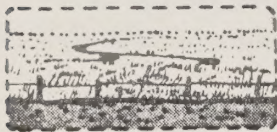
1. Restrictions shall be placed on non-essential inappropriate uses between the scenic route and the primary river view. Only those commercial uses or public facilities which are river-oriented and require direct water access (marinas, boat launching) or immediate river views (restaurants) shall be permitted.

FOREGROUND COMPONENT

SPECIFIC POLICIES

2. Uninterrupted masses of structures, long fences, and vegetative screens which form a continuous barrier disrupting river views shall be prohibited.
3. Fencing around private property which obscures river views shall be prohibited.
4. Signs for commercial purposes shall be attached to and made an integral part of the structure to which they relate. Uses of free-standing signs shall be prohibited unless placed in a manner which will not obstruct river views.
5. Mandatory undergrounding of utility lines is highly recommended between the scenic roadway corridor and river views.

B. Marshlands



1. Adjoining dry lands and uplands within and around a marsh shall be restricted to natural grazing, cropland, or other extensive open space uses.
2. Existing animal and vegetative habitats shall be protected from encroachment.
3. Public roadway construction and improvement activities shall be subject to restrictions permitting natural water movement necessary to sustain the marsh environment.
4. Mandatory undergrounding of utility lines is highly recommended.

C. Flat Grasslands



Note: Specific policies for components C and D are the same.

1. Current general plan provisions which maintain these areas in open space uses shall be maintained.
2. Development shall be regulated to minimize obstruction of vulnerable background views.
3. Introduction of new structures shall be limited to those

FOREGROUND COMPONENT

SPECIFIC POLICIES

D. Flat Cropland



which are demonstrated to be auxiliary to an open space or cropland use (intensive or extensive agriculture, recreation); and shall be clustered in compact configurations to minimize visual disruption.

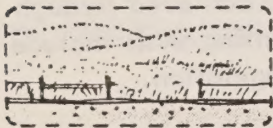
4. Setbacks from the roadside property line of approximately 250 feet should be encouraged, and of at least 100 feet shall be required, for allowable structures in order to minimize the prominence of a structure and its interference with the open appearance of this view component.

5. In order to maintain a frequency of roadside structures compatible with this visual component, current large-site zoning (specifically extensive and intensive agriculture, i.e., A-80 and A-40 zones) shall be maintained and a minimum road frontage distance of 500 feet shall be required in those zones.

6. Mandatory undergrounding of utilities is highly recommended where lines disrupt vulnerable background views (Background Components 5, 6, 7 and 9).

7. Signs auxiliary to commercial uses shall be prohibited unless sign is an integral part of a related structure and does not protrude above the structure more than five (5) feet in height.

E. Rolling Grassland



1. Specific policies C-1 and C-6 apply.

2. Development shall not be permitted in those presently undeveloped areas which are highly visible from the scenic roadway due to the natural terrain and the lack of sheltering vegetation. Where there are no reasonable site alternatives, development of such land shall be permitted, providing that construction is limited to the less visually obtrusive portions of the site, buildings are grouped rather than dispersed within the site, low building profiles are maintained, and screening techniques, such as earth berms, are used to reduce roadway views of structures, roads and parking.

**FOREGROUND
COMPONENT****SPECIFIC
POLICIES**

3. Development shall be integrated into the natural visual environment through density restrictions based on a site's visual and natural values and through sensitive building location.
4. Grading of a development site shall be restricted to minimize alteration of the natural terrain. Padding shall be prohibited and the use of adaptive foundations shall be encouraged to accommodate topographic variations while minimizing cut and fill.
5. Homesites and other improvements shall be prohibited from upper hillsides, hilltops, and ridges in order to preserve the visual integrity and significance of barren hill forms as viewed from the scenic roadway. Buildings should be placed in low lying areas.
6. Development shall be prohibited from highly visible steeper slopes (15% +) where the gradient would cause man-made alteration to be highly visible and discordant with the barren topography.
7. Proposed major developments shall be subject to site and design review by qualified city or county staff or by consultants to the staff. Review should ensure that structures are designed (form, materials, color) and sited to be subordinate to the surrounding natural environment. Buildings, roads, and parking shall be screened as much as possible from scenic roadway view to reduce the extent of apparent man-made intrusion. Screening can be achieved through the use of berms or planting. Such planting shall include heavy use of native and semi-native vegetation.
8. New landscaping and introduced planting which will be visible from a designated scenic roadway shall include heavy use of native species. Hilltops and upper hillsides shall be protected from non-native plant invasion.

FOREGROUND COMPONENT

SPECIFIC POLICIES

F. Grass-Woodland Hills



1. Specific policies C-1, C-5, C-6, E-3 through E-5, E-7 and E-8 shall apply.

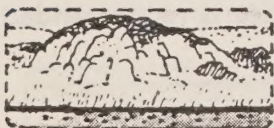
2. Current general plan provisions which maintain these areas in open space uses shall be maintained.

3. Development shall be limited on highly visible steeper slopes (15%+) to areas where existing woodland will screen structures to minimize exposure to scenic roadway view. Man-made alterations shall be permitted only where there are no reasonable site alternatives. Where development of such lands is permitted, structures shall be sited and designed to minimize visual disruption of hillside.

4. New structures screened by existing trees shall be prohibited from breaking through the tree canopy.

5. Grading within wooded areas shall not encroach upon the root structure of existing native oak root crowns nor upon riparian areas.

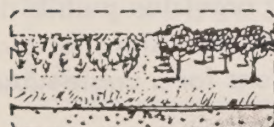
G. Steep Hills with Rock Outcroppings



1. Provisions C-1, C-5, C-6, E-3 through E-5, E-7 through E-10, and F-3 shall apply.

2. Development which obstructs the view from a scenic roadway to unique land forms shall be prohibited.

H. Vineyards and Young Orchards



1. Current intensive agricultural land uses shall be retained as the primary land use classification of vineyards and young orchards.

FOREGROUND COMPONENT

SPECIFIC POLICIES

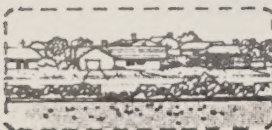
2. Proximity of trees and grapevines to the edge of a scenic roadway right-of-way shall be maintained.
3. Auxiliary signing related to roadside commercial shall be allowed on the condition that sign height shall not exceed five (5) feet, each side shall not exceed 15 square feet in area, all sides shall not exceed 30 square feet in area; and use of natural materials shall be encouraged.
4. Only new structures which can be demonstrated to be auxiliary to current extensive agricultural land use designations shall be allowed.
5. New structures shall be set back a minimum distance of 100 feet from the roadside property line.
6. Mandatory undergrounding of utility lines is highly recommended where vulnerable distant views are obstructed (Distant View Components 5 through 8).

J. Mature Orchards



1. Specific policies H-1 through H-4 shall apply.
2. New structures shall be set back a minimum distance of 100 feet from the roadside property line.
3. Mandatory undergrounding of utilities is recommended, although not visually essential.

K. Residential



1. Protection of vulnerable distant views shall be the primary concern.
2. All new residential developments of five (5) units or more shall be required to include a covenant provision prohibiting use of rooftop antennas and shall include provisions for a community antenna plus alternative provisions for a cable subscription hookup.

FOREGROUND COMPONENT

SPECIFIC POLICIES

3. Undergrounding of utilities is highly recommended where vulnerable background views are obstructed.
4. Special consideration should be given in the development review process to the design and materials used for roofs where the scenic roadway is elevated above the grade level of the housing area.

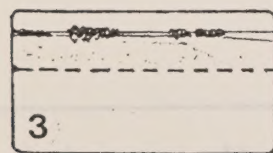
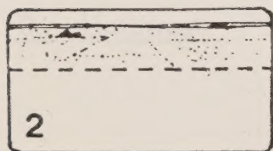
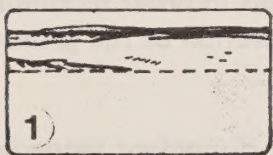
L. Commercial/Industrial



1. Specific policies K-1, K-2, and K-4 shall apply.
2. Signs associated with a commercial use shall be an integral part of a related structure and shall not protrude above the structure more than five (5) feet in height.

DISTANT VIEW COMPONENT

SPECIFIC POLICIES

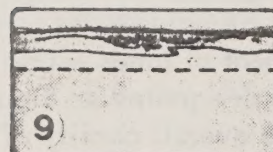
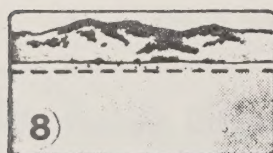
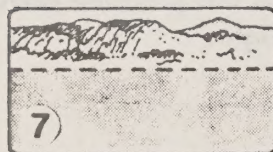
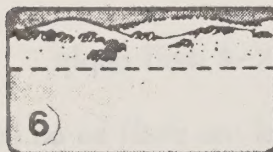
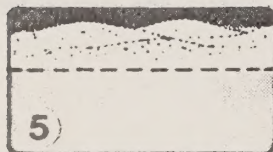
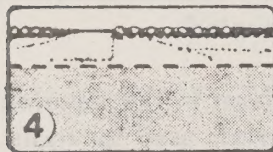


Note. The following specific policies shall apply to all distant view components designated on Figure 1.

1. In general, any proposed development of lands within the distant component of a visual unit, as designated on Figure 1, which will obstruct or detract from the overall quality of that distant view shall be avoided.
2. Any proposed foreground land use which is allowable under other specific policies of this element shall be designed to minimize obstruction of the distant component of a visual unit, as designated as Figure 1.
3. Where urban and suburban land uses are permitted on lands within the distant component of a visual unit as designated on Figure 1, one of the following two basic design alternatives should be encouraged:

DISTANT VIEW COMPONENT

SPECIFIC POLICIES



a. Soften the contrast between the proposed development and its natural setting through use of building clustering and low building profiles which together will minimize obstruction, alteration, and disruption of significant land forms; through limiting the use of exterior building materials and colors to those which serve to blend structures into their natural setting and background; through heavy use of native and non-native plant species in development landscaping; and through use of berms and planting to screen the development from the roadway view.

b. As a basic design feature, emphasize the contrast between the proposed development and its natural setting through dramatic massing of structures and through a focused, compact overall development configuration.

4. Where urban or suburban land uses are permitted on lands within a designated distant view component (Figure 1), the following measures should be taken by the county and cities:

a. Limit overall densities to low levels in order to minimize the extent of visual disruption or alteration of the primary elements of the distant view.

b. Avoid the introduction of visually discordant secondary elements such as rooftop television antennas, disruptive overhead utility lines, billboards, etc.

SPECIAL FEATURES

SPECIFIC POLICIES

A. Roadside Shade Trees

1. Visual units which are distinguished by mature shade trees lining the side(s) of the scenic roadway (as symbolized in Figure 1), shall be protected and maintained.

SPECIAL FEATURES

SPECIFIC POLICIES

Where appropriate, such shade tree rows should be maintained and reinforced by a program of replacing diseased or aged trees.

B. Creeks

1. Development shall be prohibited from obstructing the roadway view of creeks, their shores, and their adjoining riparian features.
2. Realignment or other road construction on a designated scenic roadway which will result in encroachment upon a stream channel shall be prohibited.
3. New creek crossings by a designated scenic roadway shall be by means of a bridge of open construction rather than through use of a culvert.

C. Eucalyptus Windbreaks

1. Maintenance and protection of existing windbreaks shall be encouraged to provide a contrasting visual barrier on flatland landscapes and to call attention to distant farm development or to places where major changes occur in the alignment of the road.
2. Where appropriate, expansion or addition of new windbreaks shall be encouraged to identify distant changes in visual units, road alignments, land use activities, etc.

D. Gateways

1. At designated visual gateways (Figure 1), construction and associated planting which obstruct views or reduce the sense of entry to or exit from a view shed shall be avoided.
2. The introduction of roadside planting (shade trees, etc.) shall be considered as a means of emphasizing the gateway effect.
3. Design of roadway improvements (road grading and alignment) at designated visual gateways should serve to maximize views and the gateway effect.

**SPECIAL
FEATURES****SPECIFIC
POLICIES**

E. Outlooks

1. Scenic pullovers and convenient vista points could be provided for the scenic roadway user at major outlooks as designated on Figure 1.

IMPLEMENTATION METHODS

The provisions of the Scenic Highway Element are designed to serve as a clear basis for county and city review of the visual implications of private development actions along designated scenic roadway corridors as well the official basis for public improvement actions such as scenic road construction or modification and the placement of utilities in view of a scenic route. Recommended implementation approaches are described below.

REGULATORY METHODS

As a primary means of implementating the policies of the Scenic Roadway Element, the county and cities should expand their regulatory programs to include the following:

Mandatory Planned Unit Development

In the following situations all major and minor subdivision applications should be required to submit plans in accordance with planned unit development provisions of the responsible local government:

1. Where the application includes lands within 1000 feet of a designated scenic roadway and is classified in any of the following foreground component categories: A. River View, B. Marshland, C. Flat Grassland, D. Flat Cropland, H. Vineyards and Young Orchards, J. Mature Orchard, K. Residential, or L. Urban (Commercial/Industrial);
2. Where the application includes lands within 1500 feet of a designated scenic highway and is classified in any of the following foreground component categories: E. Rolling Grassland, F. Grass and Woodland Hills, or G. Steep Hills with Rock Outcroppings;
3. Where the application includes lands classified in any of the following Distant View categories: 5. Rolling Grassland, 6. Grass and Woodland Hills, or 7. Steep Hills with Rock Outcroppings; and when the staff has determined that the visual prominence of the site from designated scenic roadways is sufficient to merit special design attention.

Sign Ordinance Modifications

The specific policies herein which are associated with certain foreground view components, specify conditions governing the use of signs including, in some

instances, size, height and placement. Implementation of these policies can be achieved in either of two ways: (1) through adoption of a series of new sign provisions which apply to various segments of the scenic roadway, or (2) through use of design review procedures which would override present sign requirements. The latter method is discussed in a separate section on Design Review Procedures below.

Use of the sign ordinance approach would require drafting of a series of new sign districts (for the various roadway segments). Provisions for each district would be consistent with the specific policies of the various foreground component categories included in the district. Sign districts should distinguish between the signing requirements of agricultural related sales in orchard, vineyard and cropland areas and the signing requirements of roadway-related services along major travel routes. The particular provisions should also recognize the differences in travel speed on the various routes and thus, the need for different requirements regarding size and placement of signs.

Official Map Lines

The provisions of the Scenic Roadway Element call for variations in the setback of structures along designated scenic roadways based on recognition and protection of landscape features inherent to the area. In order to administer these provisions, the county and cities could, where necessary to carry out the specific policies formulated for the different visual units, map and adopt official map lines requiring building setbacks in excess of those normally required in the zoning ordinance. Although official map lines have conventionally been used to protect against encroachment by structures along right-of-ways which might have to be expanded to meet future travel demands, use of official map procedures for protecting the scenic quality of the roadway would also be appropriate. Official map lines could be administered as a part of the normal building permit approval process.

Design Review Procedures

The regulatory provisions suggested above are designed to reduce the reliance on design review procedures to carry out scenic roadway policies. There may be, however, areas highly subject to change where the county or cities may wish to backup these regulatory provisions with additional design review procedures. It is recommended that a design review ordinance be adopted to enable the county and cities to undertake such review measures. The ordinance should be drafted in a manner which establishes the policies of the Scenic Roadway Element, and other portions of the General Plan, as the official criteria to be used in reviewing a project and determining its acceptability. The intent is to establish a more precise, plan-based review process rather than a process which relies primarily on generalized statements of intent which would be subject to wide variations in interpretation.

A plan-based approach would also provide a firmer legal basis for the design review procedure, since the local legislative body will have formally adopted the review criteria (the general plan).

It is also recommended that the design review function be carried out by the county or city staff rather than by an appointed design review committee since a staff arrangement is more likely to result in consistent decisions. Aspects to be covered in design review should be carefully limited to include only those which directly relate to adopted policies applying to the specific site. In one area, for example, only the siting of structures might be regulated while in another the siting of structures plus the building profiles and associate landscaping may be regulated.

Other Methods

In addition to the regulatory methods described above, implementation of the Scenic Roadway Element will be carried out by the cities and county in their public improvement program. Specifically, the Scenic Roadway Element should be consulted and applied as a basis for determining the priority of State PUC utility undergrounding funds. Similarly, the Scenic Roadway Element should provide a basis for determining the level and type of roadway improvements to be made on scenic routes. Although scenic concerns are not the sole, and in many instances, not the primary basis for roadway design decisions, the provisions of the Scenic Roadway Element should be used as a basis for determining if pressures for increases in roadway speed and thus roadway lane width, curvature, shoulder size, etc., are appropriate.

Finally the county or cities may wish to retain a design consultant to assist their staffs in reviewing projects for compliance with the scenic roadway provisions. This arrangement has the advantage of retaining direct staff involvement, while supplementing staff when necessary with outside design assistance. At the same time, if the consultant were retained on a regular basis, it would promote consistency in the decision making process. Financing of this service could be provided for through a review fee requirement for each application.

PRELIMINARY DRAFT
GENERAL PLAN REVISION PROGRAM

ENVIRONMENTAL IMPACTS

Prepared for the

CITY OF SOLANO
CITY OF FAIRFIELD
CITY OF VACAVILLE
CITY OF SUISUN

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BACKGROUND

PROJECT DESCRIPTION

The Health and Safety and Scenic Roadways elements of the Solano General Plan are required by State law to address local concerns for public safety and the preservation of scenic routes, respectively. The two elements are formulated to become additional components of a comprehensive General Plan which already includes elements which address concerns for land use, circulation, housing, conservation, and open space.

Major portions of the land within the planning area are subject to a variety of natural hazard factors related to slope instability, seismic activity, ground failure, flooding, and fire hazard, which threaten community health and safety. Noise, primarily a man-induced hazard, is also a factor threatening to public health. The objective of the Health and Safety element is to identify the areas where such natural and man-induced hazards to life and property occur and to provide development and protection policies which specifically respond to those hazards. The element will guide the county and participating cities in determining what types of land uses shall be permitted or promoted in various areas, how and where to build public facilities, and which type of public services should be provided.

The purpose of the Scenic Roadways element is to offer travelers a visual experience which includes an unhindered and representative cross-section of the significant natural, historic, rural and urban characteristics of the planning area. The element is formulated to establish or designate a system of scenic driving routes and to maintain the system through specific sets of policies to protect and enhance the view experience from the road. Policies include a series of precise guidelines for use in the regulatory process under which new development may be properly integrated into the roadside environment. These scenic route guidelines will serve as standards for the review and approval of various roadside developments within a designated scenic corridor.

ENVIRONMENTAL SETTING

Solano County, located halfway between the San Francisco and Sacramento Metropolitan Areas, is bounded on the south by San Pablo Bay, the Carquinez Straits, Suisun Bay, the Sacramento River, and Contra Costa County; on the west by Sonoma County, Mare Island Straits, the Napa River, and Napa County; on the north by Yolo County; and, on the east, by the Sacramento River, Sacramento County and Yolo County. Solano County, with an area of 827 square miles, is divided into two topographic sections: (1) the level agricultural lands of the Sacramento Valley to the east, together with the marshes of Suisun and San Pablo Bay and the islands of the Sacramento River delta, and (2) the mountainous, low-lying ranges to the extreme west. The county experiences a mild and temperate climate, one reason for its success as an agricultural center.

Solano County is generally an agricultural community with a growing industrial market. In 1972, the population of the County was 181,900, more than three times what the population had been before the Second World War, with the cities of Fairfield, Suisun City, and Vacaville comprising approximately 42 percent of the population. As part of the nine-county San Francisco Bay Area, it is expected that 4.4 percent or more of the Bay Area population will live in the county by 1990, an increase of .7 percent from 1970. The rapid growth of the county after the Second World War is primarily due to three factors. Interstate 80, which connects San Francisco-Oakland with Sacramento and which passes through Solano County and six of the seven county cities, is a major source of urbanization. Urbanization is expected to continue along this highway corridor, eventually creating a continuous built-up area between the two communities of Fairfield and Vacaville. Secondly, the widening of Highway 40 and the Benicia-Martinez Bridge has brought and will continue to bring new businesses and residents to the county. And finally, the government has served as a major employer in the greater Vallejo-Fairfield-Napa Metropolitan Area, accounting for more than 40 percent of total employment. This high figure is accountable principally to the local existence of such government installations as Travis Air Force Base, Mare Island Naval Shipyard, and the Naval Communications Facility at Skaggs Island.

The following Table E1 provides a reference to the specific sections of general plan elements which contain more detailed descriptions of both natural and man-related conditions in the planning area:

TABLE E1 ENVIRONMENTAL SETTING - REFERENCE TO
GENERAL PLAN TEXT DESCRIPTIONS

NATURAL RESOURCE VALUES.....	Page
Land Resources and Agricultural Production.....	RCOS IV-1 ¹
The Suisun Marsh.....	RCOS IV-6
The Napa Marsh.....	RCOS IV-10
Land Capability Classifications and Soil Types.....	RCOS IV-12
Air and Energy Sources.....	RCOS IV-20
Mineral Production.....	RCOS V-4
Fish and Wildlife Habitats.....	RCOS V-5
Notable Land Forms and Scenic Features.....	RCOS V-8
Protected Waterways.....	RCOS V-9
HAZARDS TO PUBLIC HEALTH AND SAFETY	
Seismic and Geologic Hazards.....	HS-51 ²
Slope Instability Hazards.....	HS-51
Landsliding.....	HS-51
Surface Faulting.....	HS-55
Seismic Shaking.....	HS-58
Ground Failure.....	HS-64
Liquefaction.....	HS-64
Subsidence.....	HS-64
Settlement and Shrink -- Swell Potential.....	HS-66
Flooding Hazards.....	HS-66
Stormwater and Tidal Inundation.....	HS-66
Tsunami and Seiche.....	HS-69
Dam Failure.....	HS-69
Canal and Levee Failure.....	HS-72
Fire Hazard.....	HS-73
Summary Areas of Special Concern.....	HS-79
Noise.....	HS-
Definition and Measure.....	HS-
Present Noise Contours.....	HS-
Planning Area Case Studies.....	HS-
Future Noise Contours.....	HS-

¹ Page references to Solano County Resource Conservation and Open Space Plan, May, 1973.

² Page references to the Preliminary Draft of the Health and Safety element by Sedway/Cooke, November, 1975.

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SCENIC VALUES.....	3
Components of Roadway Views.....	SR-2
Visual Units.....	SR-2
Components of a Roadway View.....	SR-3
Foreground Views.....	SR-4
Figure 1.....	SR-8
Distant Views.....	SR-6
Figure 1.....	SR-8

³ Page references to Preliminary Draft of the Scenic Roadways element by Sedway/Cooke, November, 1975

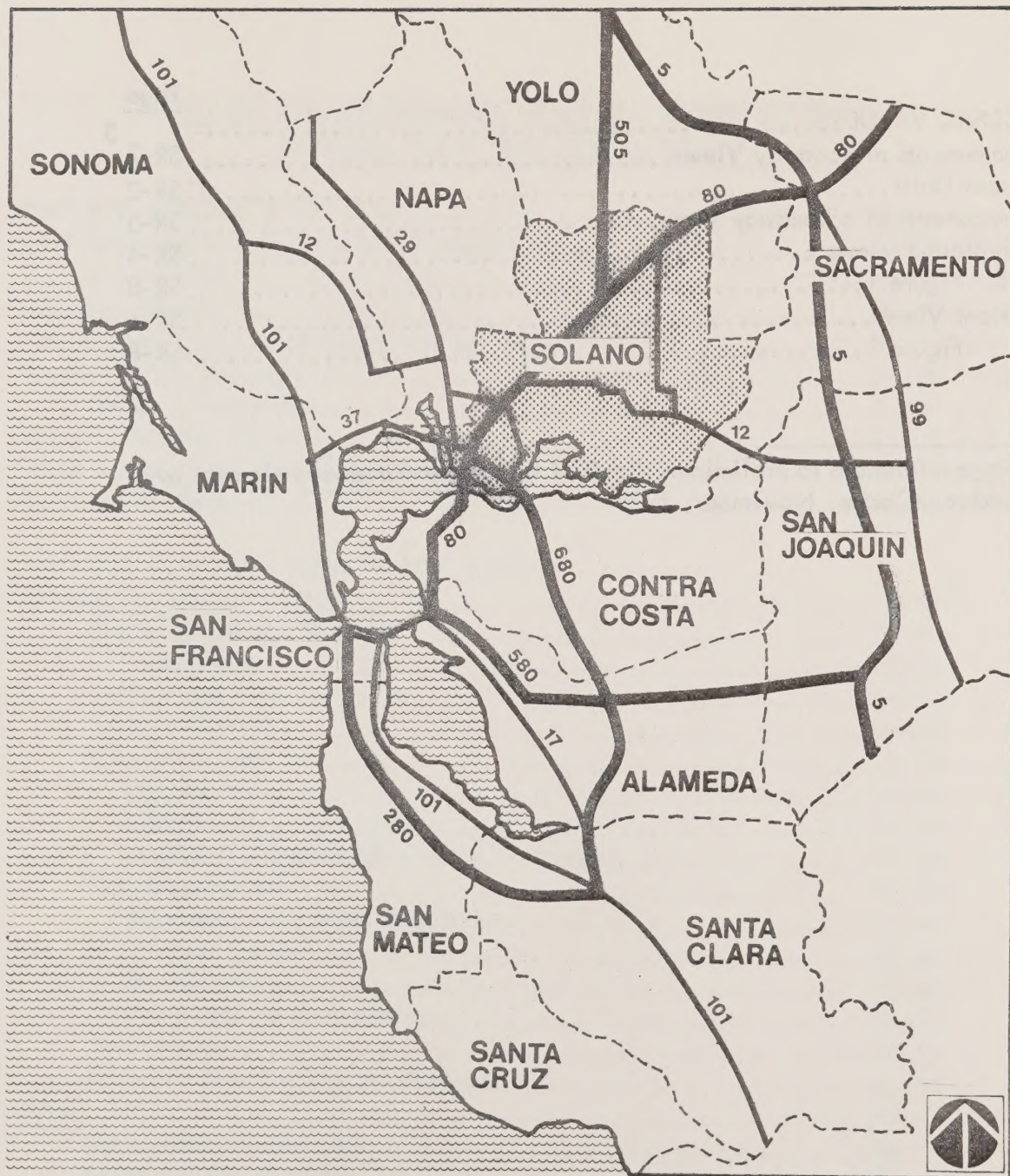


FIGURE 1
REGIONAL SETTING AND ACCESS

ASSESSMENT OF IMPACTS

NATURAL RESOURCE IMPACTS

The following natural resource factors will be affected by implementation of the provisions of the Health and Safety and/or Scenic Roadways elements: natural habitats, scenic-recreation values, and water quality. The specific impacts associated with each category are discussed below:

Natural Habitats

A number of the specific plan policies included in the Health and Safety and Scenic Roadways elements are directed towards the prohibition of development encroachment on the planning area's extensive mountainous areas, marshlands and riparian corridors. Although such policies are included in these elements for the primary purposes of abating hazards to public safety -- landsliding, liquefaction, flood and fire -- and protecting scenic roadway views, effective implementation of these policies would have the secondary effect of improving and protecting natural habitats associated with mountain, marsh, riparian and estuarine areas.

Specifically, plan restrictions on the development of (a) steep lands with landslide deposits, (b) other lands which are landslide-prone, (c) mountainous lands which are extremely or highly wildfire-prone, and (d) marshlands which are liquefaction-prone and highly vulnerable to visual disruption by development, will have an additional positive environmental impact in serving to protect the significant and unique vegetative and animal habitats associated with these lands. The protection of water quality and thus, water habitats in planning area creeks and lower estuaries will be realized as a secondary effect of a number of element policies including (a) slope instability provisions which would mitigate erosion potentials and resulting sedimentation; (b) flood provisions which would mitigate upstream and downstream flooding and sedimentation problems associated with increased volumes and rates of run-off due to certain land alteration practices and the covering of permeable soils with impermeable development; (c) fire abatement measures which would decrease the likelihood of increased run-off, erosion, and sedimentation into streams from burned hills; and (d) Scenic Roadway provisions which would serve to protect riparian corridors from encroachment by development.

Scenic-Recreation Values

The preservation of scenic and recreational values is inherent in the Scenic Roadways element which specifies the retention and protection of areas with high scenic value as seen from certain designated routes. Furthermore, the Health and Safety element proposes to prohibit development on lands designated as underlain by landslide deposits (Type A lands) and on lands designated as extremely prone to wildfires. The element provides for development restrictions on lands designated as susceptible to future landsliding (Type B lands) and on lands considered highly wildfire or grassfire prone. The result of these provisions is the retention of planning area open space and visual relief from dense urbanization. Where new development is permitted under these provisions, it has been stipulated to be executed in a manner which would minimize the disruption of the existing scenic values.

In summary, the specific policies contained in the Health and Safety and Scenic Roadways elements of the General Plan serve to preserve certain scenic and open space values which presently exist in the planning area and to enhance these values by assuring their permanent protection. No major adverse impacts on these values is foreseen as a result of the two new elements. Assurance of identified positive impacts, however, will depend upon the successful adoption of the implementation provisions contained in both Plan elements.

Water Quality

As discussed under the previous discussion on Natural Habitat impacts, certain specific policies of the Health and Safety and Scenic Roadways element will result in positive effects on water quality. Provisions which prohibit or restrict development in landslide and fireprone hills, atop permeable soils, and along riparian corridors for reasons of public safety will also abate development-induced erosion, increases in the volume and rate of run-off, creekside slumping, and increased sedimentation in planning area streams and channels. Specifically, water quality in the planning area will be protected through the implementation of (a) slope instability provisions which will serve to avoid erosion and sedimentation resulting from alteration of unstable slopes; (b) the adoption of wildfire prevention measures for watershed lands; (c) upstream flood provisions prohibiting encroachment on creeks by development; (d) downstream flood abatement measures; and (e) provisions to abate hazards associated with the Putah South Canal thereby maintaining the quality of canal water.

The protection of the marshlands along Suisun and San Pablo Bay is also realized as a result of development restrictions relating to abatement of liquefaction hazards and protection of roadway areas. Preservation of the marsh is critical to the protection and improvement of planning area water quality, since the marsh and its vegetative habitats serve as a filtering mechanism which purifies runoff waters before releasing them into estuarine waters and the Bay.

HAZARDS TO PUBLIC HEALTH AND SAFETY

Seismic and Geologic Hazards.

The Public Health and Safety element of the General Plan has identified those areas in Solano County which have severe seismic and geologic hazards associated with land supply, and has set forth policies to mitigate these hazards. The most significant of the seismic and geologic hazards identified has been slope instability, followed by potentials for local surface faulting and earthquake-induced liquefaction. To ensure that development is stringently controlled on land with such seismic or geologic hazards, the Plan recommends specific implementation techniques. The primary techniques recommended are use of mandatory planned unit development procedures and adoption of a land capacity ordinance. The latter would establish allowable densities based upon the documentation of whether a site is buildable or unbuildable. Therefore, development on lands which have active slides or which are highly landslide-prone would be prohibited or restricted. Development on a site traversed by an active fault or with areas highly susceptible to liquefaction would be limited accordingly. The remaining land supply which is generally free of major constraints would constitute the area which would be used in the land capacity ordinance to calculate the allowable density.

Slope Instability. In the planning area, there are three factors contributing to slope instability: wet winters, the likelihood of seismic shaking, and encroachment on unstable areas by development. It is especially important that the standards applied to address these three particular factors be stringent. Therefore, the Health and Safety element recommends that the determination of whether a site is buildable or not depend not only on the ability to stabilize the specific site to be occupied by the building, but also on assurances that roads, sewers, water, power and gas lines will not pass through areas which are likely to have slope failures. Consideration for such support facilities becomes especially critical under seismic shaking conditions which increase

fire hazard, threaten to restrict access to the area for emergency vehicles, and may interrupt the water supply necessary for fighting fires created by an earthquake. For the most part, slope instability conditions coincide with areas which have high fire potential, further emphasizing the need for stringent control governing development in such areas. The Plan therefore has placed special emphasis upon control or elimination of development where such conditions exist.

Surface Faulting. Geologic evidence indicates that the planning area is traversed by a number of faults which could cause serious structural damage to overlaying facilities. Plan provisions respond to the various surface faulting hazards by: (1) recommending development restrictions in fault areas, particularly the Green Valley Fault; (2) providing for the preparation of specific or precise development plans (special area plans) in order to better assess the environmental impact; (3) in certain situations, requiring a site investigation by a registered geologist; (4) the hiring of a registered engineering geologist by the County and cities to evaluate all geologic reports; (5) restricting highways and electric, gas and water lines from traversing areas of potential surface faulting hazards; (6) planning contingency earthquake disaster routes as alternatives to those currently designated principal evacuation routes which cross active fault traces; and (7) initiating a joint data collection program by the county and cities to accumulate geologic information relevant to development review and planning purposes for all faults which are in proximity to developing areas.

Seismic Shaking. Plan provisions address the various hazard conditions associated with seismic shaking. The first of these is the slope instability problem previously discussed. The second deals with the problems of ground failure or liquefaction. This problem is generally concentrated in the existing and former marsh areas of the county which are underlain by saturated bay mud, and in the areas of prime agricultural soils with high water tables in the central and western portions of the county. While the Plan does not specify a total or absolute prohibition of development in these areas, it does require that adequate investigations be undertaken prior to development to assure that safe development can be provided. Because of the differing opinions which still exist among professional geologists and structural engineers as to the specific criteria to be applied to such areas, the Plan recommends independent review of all major development applications on such lands, excluding one- and two-family woodframe dwellings. In addition to dealing with slope instability and liquefaction problems created by seismic activity, the Plan specifies the need for building standards which protect against shaking damage generated by a major earthquake. The Plan recommends: (1) that all new buildings conform with the latest seismic structural standards of the Uniform

Building Code; (2) that the structural design of new buildings for public occupancy be responsive to the characteristics of underlying geology and be reviewed by a civil or structural engineer; and (3) that a seismic hazard abatement program which applies to old masonry buildings, parapets, protruding signs, etc., be established.

Flood Hazards

A major portion of the flat low-lands in the planning area are subject to inundation due to heavy rainfall and the resulting stream overflow. A number of streams in the planning area have long histories of seasonal flooding, often resulting in significant damage. The Plan specifies provisions for downstream land use by which any development occurring on the primary flood plain would have to be constructed at a sufficient elevation to protect against flood hazard. In order to retain the natural function provided by such flood plains, provisions are also set forth to ensure that unnecessary filling and diking of the flood plain does not occur as these actions would thereby reduce the flood plain and contribute further to the problem of flood control. The Plan also recommends the implementation of flood-proofing, flood control, and drainage improvement measures throughout the extensive areas of existing urbanization on designated flood-prone lands.

Additionally, the Plan sets forth policies for upstream land use which serve to reduce potentials for downstream flooding. Such provisions include retention of upstream watersheds in open space uses, and regulation of land use activities which contribute to increased rates of run-off.

Fire Hazards.

The land use policies of the Plan have been designed to prohibit development in areas where there is extreme fire danger and to restrict development in areas of high fire danger. Development prohibition provisions apply generally to the upper slopes of the Vaca Mountains where the combination of chapparal, vegetation, steep slopes, poor access, and wind conditions produce extreme fire hazards. Development restrictions in areas of high wildfire risk include strict density limitations and require grouping of residential structures for efficient fire protection. The Plan also includes provisions for fuel buildup abatement, firebreaks, and restrictions on use of fire-prone exterior materials in residential construction.

Noise

The principal source of noise in the planning area is vehicular traffic, followed in intensity and impact by local airport and railroad operations. The Plan provisions seek to control noise at its source and at its impact points through noise buffering along major arterials, noise abatement design measures, trucking restrictions, regulation of fixed point sources, and enforcement of vehicular and construction noise standards.

Standards for maximum noise levels which will be compatible with various land uses have been developed using Federal EPA and Highway Research Board data. The Plan's provisions suggest that the county should apply these standards as criteria in determining noise-land use compatibility. The standards should be applied as a measure in determining the acceptability and placement of specific land uses near a freeway or local arterial.

The main emphasis of the Health and Safety element has been on abatement measures for the various geologic, seismic, flood, fire, and noise hazards. Therefore, in these sections of the General Plan, there is inherently little or no negative impact. The most significant adverse impact would be to some private landowners whose economic expectations might be decreased due to new limitations on land use. This subject is discussed further under Socio-Economic impacts.

FISCAL IMPACTS

Open Space Land Preservation

The Plan provides for designation of extensive lands to open space uses ("non-urban uses") as a result of the natural hazards and physical constraints that exist. Many such areas which are severely constricted by geologic and seismic hazards and are therefore designated in the Plan as unbuildable, would be maintained in their non-urban status through use of regulatory methods. These provisions are complementary to provisions in the Open Space and Conservation Element of the General Plan and reduce or eliminate the need for expenditure of public funds for open space preservation.

Provision of Additional Public Facilities and Services

A complicated factor in the determination of fiscal impacts of these health and safety and scenic roadways provisions is the consideration of the reduction in fiscal cost produced by the elimination of hazard-prone development which would have otherwise occurred. The development pattern which would occur if designated hazardous areas were developed without the application of this Plan element is one which would be very costly to maintain and service and which would result in the need for various additional public service activities.

As discussed in an earlier section on Public Facilities impacts, if the new elements were not implemented, the county and cities would be subject to future problems associated with the maintenance of roads in unstable hill areas, a more difficult service pattern for both police and fire protection services, and a need for greater and less efficient road, sewer and utility lengths to serve development in the hilly areas. And, in the event of a major earthquake, it is quite clear that there would be very high public costs associated with restoring services into these areas.

Administrative Costs

Adoption of the new elements will establish a need for (1) additional development review responsibilities for local staffs in administering the added general plan and related ordinance elements; and (2) additional building inspection activities. These staff costs should be counterbalanced, however, by concurrent reductions in maintenance and repair costs which would otherwise be incurred by local governments due to urbanization of areas unsuitable for safe, hazard-free development.

Schools

The need for costly noise abatement measures could be significantly reduced in future school expansion programs if the noise provisions of the Plan were properly implemented.

Fire Protection

Plan restrictions on development in fireprone areas and provisions for fire abatement would serve to reduce the need for additional facilities and the likelihood of increased fire-fighting activity generated by further urbanization.

IMPACTS ON PUBLIC FACILITIES

Circulation

Certain provisions of the Scenic Roadways element may serve to discourage increases in traffic movement, volume, and speed. The satisfaction of demands for traffic volume and speed increases on designated scenic routes would be stymied by proposed provisions discouraging road widening, creek encroachment, speed increase, and other measures associated with improving local and regional circulation. Furthermore, provision of access to and through areas designated as highly fireprone and/or landslide-prone by public roads would be restricted by proposed Health and Safety element provisions.

On the other hand, certain landslide, ground failure, fault rupture, seismic safety, flooding and, less directly, fire hazard provisions of the Health and Safety element will serve to keep maintenance and repair costs in check and will help avoid natural disruptions of local traffic movement.

Water Supply and Sewer Collection and Treatment

The likelihood of service interruptions, maintenance and repair costs incurred as a result of landslides, ground failure, fault rupture, seismic shaking, and flooding would be significantly reduced through the adoption and effective implementation of the Health and Safety element. The Scenic Roadway element will have little or no impact on these facilities.

Schools

New and existing schools will be less likely to experience problems of noise intrusion, if the noise provisions of the Health and Safety element are effectively implemented. Moreover, the Health and Safety provisions serve to promote a more consolidated urbanization pattern and thus a more serviceable pattern for educational purposes.

Recreation Facilities

Provisions of the Scenic Roadways and Health and Safety elements which would limit development in open space lands for reasons of scenic protection and hazard mitigation serve to increase recreational opportunities and protect lands with high recreation value.

The overall effect of the various provisions of the Health and Safety and Scenic Roadways elements which restrict development in outlying hazardous areas and in scenic corridors would most likely be a redistribution of projected growth towards the inner areas of the county, resulting in public service economies. If these provisions were not adopted and implemented and development was permitted in a more dispersed manner in areas with severe slope instability or fire hazard problems, public costs would probably increase due to greater maintenance needs for roads, sewer and water lines, and the higher cost of fire and police protection.

ECONOMIC IMPACTS

Primary economic impacts likely to result from effective application of recommended Health and Safety and Scenic Roadway plan policies are enumerated below.

Land Costs.

In some cases, owners of private lands, especially in areas where potentially dangerous natural hazards exist such as geologic, seismic and fire hazards, would likely experience a reduction in their economic expectations. This is due to the fact that the present zoning does not adequately take into consideration such hazard factors, thereby encouraging assumptions that all of the land zoned for development is safely developable. Application of formulated Health and Safety policies and associated implementation methods (land capacity ordinance) in determining density would provide a more accurate estimate of the amount of land which is truly developable. In the mean time, current income expectations of some present property owners are not likely to be met. This would in turn lead to decreases in land values in these areas.

Housing Costs.

Housing costs would be affected in two ways by the proposed new elements: (1) by Plan provisions requiring more demanding public and private safeguards for construction where natural hazards exist; and (2) by Plan provisions affecting the allowable location and type of housing.

Cost increases in housing can be expected in those areas where more stringent safety provisions apply since it would require both greater land area per dwelling in hill areas as well as added construction and site preparation costs

for certain hill and lowland sites. Application of the land capacity ordinance, however, should help offset these cost increases by promoting land sales at prices which more closely relate to a realistic appraisal of density potential. Overall, no major impacts on housing cost are expected since the supply of buildable, i.e., relatively unconstrained, residential land far exceeds projected long-range requirements. In general, abatement of conflicts between development and natural constraints serves to check costs of public services such as repair and maintenance of public facilities, and thereby serves to reduce the need for related tax assessments and resulting increases in housing costs.

The noise provisions of the Health and Safety Element, however, are likely to result in housing cost increases, especially in already built-up areas where it is difficult to abate noise intrusions by site planning methods. In relatively undeveloped areas, noise reductions can be achieved by siting residences back from the noise source. Losses in useable land can, in turn, be compensated by use of density-transfer provisions. In the long run, the noise provision will help promote neighborhood stability and protection of property values.

Employment Opportunities

Provisions of the two plan elements would have little significant impact on employment opportunities. Although many potential construction jobs would be eliminated in areas recommended for development prohibition due to certain constraints, the extent of vacant developable land in the planning area is more than adequate to meet foreseeable demands in retail, service, industrial and housing construction, and would thereby result in merely redirecting these construction activities to other parts of the county.

Certain recommended programs for fire abatement and stream maintenance would provide limited local employment opportunities on a seasonal basis in such areas as fire-break maintenance, roadside fuel-break maintenance, etc.

CULTURAL IMPACTS

The Scenic Roadway element establishes and protects a system of routes which together provide views of historic, architectural, archaeological, ecological or educational significance. This element will have a valuable educational effect in that the scenic roadway system provides travelers with visual cross sections of the planning area, its natural resources, its agricultural values and heritage, its history of development and current urbanization trends and, from upland overlooks, its regional setting.

SOCIAL IMPACTS

Since the extent of vacant, buildable land with residential amenity is still great despite the restrictions which are proposed in the Health and Safety and Scenic Roadways elements, the major portion of new development will most likely be directed into areas which presently are not established neighborhoods, and thus very little change in the social structure of the existing community is anticipated as a result of the Plan's policies.

ENERGY CONSERVATION

Unlike a specific development proposal where precise calculations can be made with respect to energy consumption, the evaluations of energy conservation effects of these two general plan elements are difficult to accurately assess. It is clear, however, that major provisions of the Health and Safety element relating to landslide and fire hazard will have some secondary effect on energy conservation. Implementation of landslide and fire hazard abatement policies will result in a curtailment of development in hill areas of the county, thereby producing a more concentrated and efficient population pattern which has less need for energy consumption.

IRREVERSIBLE ENVIRONMENTAL CHANGES

For the most part, the Plan policies of the Health and Safety and Scenic Roadways elements would act to preserve the prevailing rural character of the planning area by encouraging the retention of the current development pattern which concentrates urbanization on the flatter areas along major transportation corridors, and by protecting from development encroachment lands which have high environmental values associated with them.

RELATIONSHIP BETWEEN SHORT TERM USES OF MAN'S ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONGER TERM PRODUCTIVITY

In general, the provisions of the Health and Safety and Scenic Roadways elements serve to preserve the unincorporated areas of the county in their present non-urban state. Most provisions designed to mitigate hazard potentials have the secondary effect of protecting natural resource values. As mentioned in previous sections, the elements would prohibit or stringently control the density of development in hill, marsh, and riparian areas. These protective measures would serve to preserve natural resource values in outlying areas and to perpetuate present short-term use trends, i.e., the concentration of urbanization on the flat Sacramento Valley floor along major regional arterials, principally I-80. Furthermore, the elements include provisions which would preserve longer-term productivity in these urbanizing areas. Ground failure provisions would have the secondary effect of discouraging development on flat lands with high agricultural values (many of these lands are identified in the Health and Safety element as liquefaction-prone), and would prohibit development on marshlands, thereby protecting extensive marsh ecosystems (marshlands are identified in the two elements as liquefaction-prone, flood-prone, and of high and vulnerable scenic value). In conclusion, then, the two elements would serve to maintain and protect long-term productivity.

GROWTH INDUCING IMPACTS

These two plan elements themselves cannot be seen as inducing or restricting growth. The factors responsible for growth are those of population and economic development of the larger Bay Area. These elements are basically devices by which the growth which is induced in Solano County can be accommodated within safe, reasonable, and acceptable limits. It should be noted, however, that certain provisions of the two elements, primarily (a) those which have the secondary effect of maintaining, improving or emphasizing environmental quality, such as policies for the protection of hill, marsh, and riparian areas, and (b) the provision of a scenic route system, can serve as a catalyst attracting people to the area because of its desirability. It is impossible, however, to predict the extent to which the rate of growth will be affected.

ALTERNATIVES

Two major alternatives to the proposed General Plan are: (1) retention of the present General Plan without these two additional elements, and (2) a substantially more restrictive Health and Safety element and more extensive Scenic Roadways element. Both of these choices are considered unacceptable for the following reason. The present General Plan fails to meet the mandated requirements of the State Planning Law and is therefore legally inadequate. Moreover, the current Plan does not provide adequate protection from significant natural and man-induced hazards; or adequate provisions for properly guiding new development along existing scenic routes in the planning area. The second choice also is considered inappropriate in terms of reasonable levels of development control and acceptable risk, and the limited availability of fiscal and staff resources. The direction chosen represents the consensus of a ten-member Technical Advisory Committee made up of principal staff people from each of the participating communities and interested local agencies.

MITIGATION

Impact mitigation measures are deemed unnecessary in this case since impact mitigation is the basis for and is inherent in these two plan elements. Any identified adverse impacts resulting from provision of these two elements are secondary to the primary environmental impacts to which each provision is addressed.

U.C. BERKELEY LIBRARIES



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